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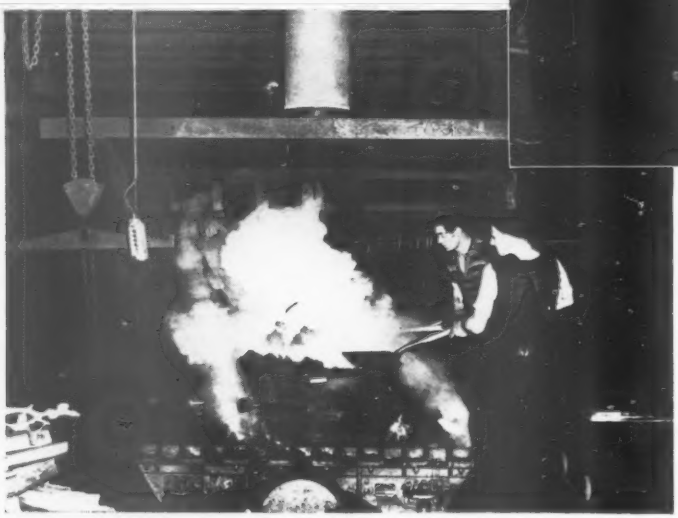

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A Ridiculous Proposal

A machine-tool is, by and large, an aggregation of castings for the static members and steel for moving parts. Thus, the foundry industry has a vital interest in the Labour Party's proposal to nationalize sections of the machine-tool industry. It is a diverse industry, ranging from what are almost instruments to huge planers and lathes. Essentially a pioneering industry, it has constantly to produce new designs to meet the ever-changing requirements of engineers. In it there are some three hundred firms employing about 42,000 people. It is in no sense a monopoly, as is evidenced by the average machine-shop, wherein there is usually a mixture of British and foreign machines. Moreover, this is also characteristic of shops on the Continent, for there is a considerable export business from this country.

The machine-tool industry is quite different from the State monopolies—such as, coal, electricity, gas and railways—where the bulk of custom comes from the man in the street. The users of machine-tools are keen engineers, who have to calculate the savings accruing from the purchase of new machines—a task in which they are helped by the machine-tool makers—, and such negotiations may involve a serious risk on either side.

To place such a business within the ambit of civil servants is quite retrograde, for it needs a type of initiative quite foreign to Whitehall, where public interest and economy should be the guiding principle. When foreign customers are dealing with civil servants, the buyer must have uppermost in his mind that in case of dispute he might feel himself unable to take legal action as he would be up against the not inconsiderable resources of a Government. Obviously, the foreigner would prefer, therefore, to place his business elsewhere, feeling he would be dealing on level terms with an individual firm. In plain English, where the civil service and kindred bodies have to deal with the masses, generally speaking, they do very well. The machine-tool business is quite different. In an enquiry for a machine, two or three makers are approached and thereafter the business becomes the affair of but two men, each accepting full responsibilty on behalf of their companies. Under the conditions of a State monopoly, there would have to be a consideration of the loading of each factory, rather than an extension of any particular works, and so progress would be stifled. There would be the same delay where a completely new design of machine was required and there would be little spur towards its completion, as such merit would in all probability not be recognized. Of all the propositions for state control, a grab for the machine-tool industry is surely the most ridiculous so far put forward.

F

Bradley & Foster Golf Competition

Despite generally showery conditions, the weather was fine for the actual time spent on the course by golfers in this year's competition for the McKenna cup organized at Whittington Barracks golf course on Friday last by Bradley & Foster, Limited. There were thirty competitors—mainly business friends and staff of the firm. Very enjoyable two-ball handicap rounds on the 18-hole course were played, finishing with tea at the " nineteenth," with the firm as hosts.

In the evening, the event was concluded in traditional style, with dinner at the George Hotel, Lichfield. Here again, Bradley & Foster entertained the guests, this time amounting to over 70 in number. Following his introduction by Dr. J. E. Hurst, J.P. (managing director of Bradley & Foster, Limited), Mr. M. Froggatt, of the Staveley Iron & Coal Company, Limited, presented the cup to the winner—Mr. K. S. Bradshaw. Second in the competition was Mr. S. Percival, and third, Mr. H. G. Turner. Short speeches of appreciation on behalf of the guests were made by the Mayor of Lichfield, Alderman L. Garratt and Mr. K. Marshall, director of the Joint Iron Council. The evening concluded with light entertainment provided by male voice singers.

THE FIRST general meeting for 1955 of the Australian branch (Victoria) of the Institute of British Foundrymen, was held at the Metallurgy School, Royal Melbourne Technical College, on March 16, with Mr. W. L. Moulding, the president, in the chair. The programme included a display of technical films, one being "The Manufacture of Britain's Heaviest Steel Casting," prepared by the English Steel Corporation, Limited.

Correspondence

SHIPPING *via* NEWPORT

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—We gave (JOURNAL, May 5) one example of Newport's high shipping charges. If the Town Clerk of Newport wants other examples so that his mind may pass from the particular to the general we are prepared to oblige. No manufacturer gets any consolation from being told that charges on him are necessarily higher than those on anyone else. Whatever the Town Clerk says, Newport must face it sooner or later. Except on isolated routes and for certain specialized cargo, Newport is seriously non-competitive.

We have been caught, and we would merely give two friendly words of warning. First to Newport—if they want to survive they will have to do something about their charges (generally as well as particularly), and secondly, to manufacturers and exporters—before you use Newport Docks get to know what their charges will be.—Yours, etc.,

for Hunt Bros. (Oldbury), Limited,
E. IVESON,
May 14, 1955. Director.

Latest Foundry Statistics

According to the British Bureau of Non Ferrous Metal Statistics the output of copper-base castings during March was 5,684 tons. The production for the first quarter of this year was 15,458 tons as against 16,156 tons during the first three months of 1954.

Figures from the Council of Ironfoundry Associations state the following numbers of ironfoundry workers were employed in the United Kingdom during the week ending February 26, 1955:—Males, 134,515; females, 10,218; total, 144,733. This represents an increase of 211 over January 29, 1955, and 3,615 over February 27, 1954.

Below are pictures taken at the first annual dinner/dance of the National Society of Master Patternmakers at the Cafe Royal, London, on May 6. On the left, the president Mr. B. Levy and Mrs. Levy are receiving—in this case, Mr. John Bell, national president of the Institute of British Foundrymen. The second picture shows a group at the top table. From left to right—Mr. and Mrs. W. G. Mochrie, Mr. and Mrs. G. B. Judd and Mr. V. C. Faulkner.

Foundry Problems and Principles

*By G. J. Rogers**

The Author uses a number of examples arising in a long experience of a diversity of foundrywork to illustrate broad principles and precepts. In this way, crystal cleavage defects are explained and cures put forward. Similarly, running and feeding methods are quoted in relation to such castings as an aluminium-bronze bush, an injector pipe, a manganese-bronze bearing cap, a Monel plate, a gunmetal torpedo-tube and cast-iron blocks. Finally, the Author gives examples of burning-on practices and views on the casting of test-bars.

THE CHAIRMAN, introducing Mr. Rogers, said he was a well-known figure in the foundry industry, especially in his own area, and in his lecture he would be dealing with what was always wanted, namely practical foundrymanship. Problems were in fact arising for every foundryman from day to day.

MR. ROGERS then gave his talk, the following being the substance of his remarks:—

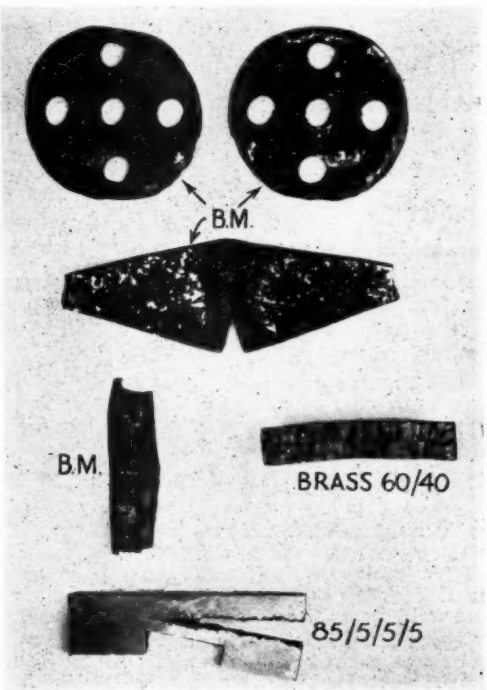
The original subject, "Some Foundry Problems," was hardly an accurate title, as it is proposed really to deal with fundamental principles. It is not intended only to deal with one or two specific problems but, based on 46 years' experience in the industry, to try to pass on some of the lessons learned—in tackling a whole range of jobs, in all branches of the foundry trade. It is felt that a commentary to supplement slides showing typical jobs and particular castings, in different alloys, and covering the whole field, will be the best way to serve the purpose.

First of all, it should be made clear that this talk is not just to show how particular jobs have been made, in order to say "this is the proper way," as the lecturer is most conscious that the same jobs can often be successfully made, or apparently so, by different methods. Instead, the intention is to put forward some points of view in order to provoke thought and discussion, with the reservation that the lecturer stands firm on the application of certain principles, which will presently be mentioned.

During the course of Admiralty employment, and in his present activities, the speaker has visited many foundries and, whilst most successful methods have been witnessed in some foundries, the unscientific approach of others has been appalling. Usually, there is the attitude that, as the castings have been acceptable to the customer, there is no need to attempt an improvement on the quality by trying other methods. Again, unfortunately, few managements will give credit to a foundryman who changes his methods and happens to run into trouble, although his object is progress. Hence, there is often the insidious attitude that it is "best to leave well alone," and for the same time-worn methods to persist for both moulding and melting, whether they be efficient and economic, or otherwise. It is this "dead hand" which has handicapped industry in this country (and still continues to do so, in many foundries), in its competition with foreign industrialists.

This sort of attitude may often allow one to "get away with it" on the normal range of iron and non-ferrous castings, but when one has to tackle special jobs in these alloys, or even more so in aluminium-, nickel- or manganese-bronze, and particularly in steel, one has to apply scientific principles if worries and costly wasters are to be avoided. These are not the days when this country can afford to try out this, that, or the other method in order to see what

FIG. 1.—*Examples of crystal-cleavage in brass and gunmetal castings.*



* Report of a lecture given to the London branch and subsequently the East Anglian section of the Institute of British Foundrymen. Mr. W. Wilson, the president, was in the chair at the London branch meeting.

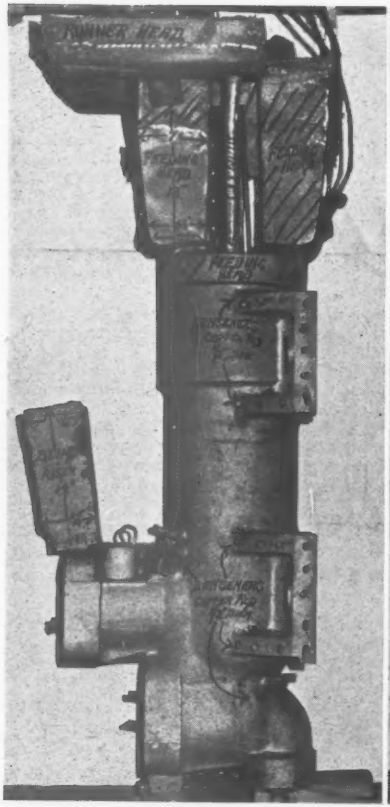


FIG. 2.—*Hydraulic pump cylinder in which there were two fractures caused by frost, when made in cast iron.*

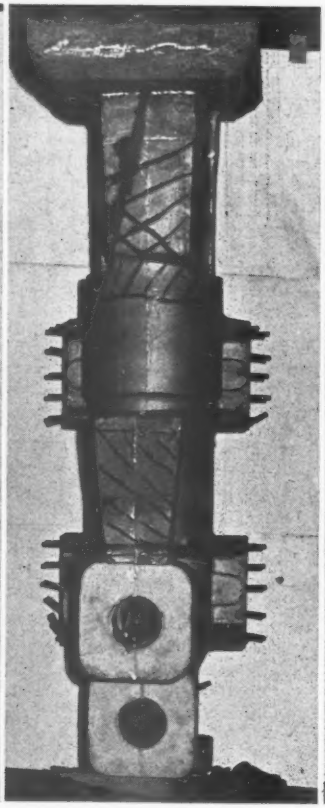


FIG. 3.—*Another view of the hydraulic cylinder; against surfaces of heavy sections cast-iron chills were placed.*

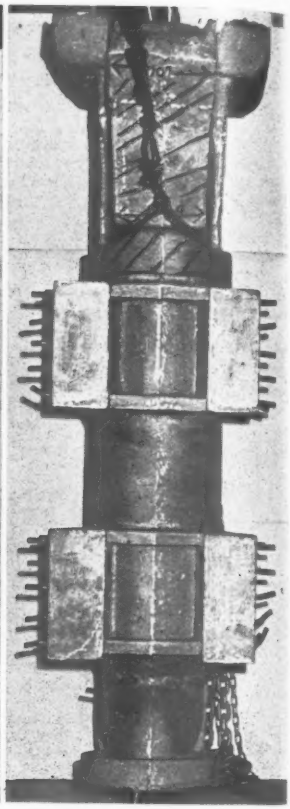


FIG. 5.—*Method finally adopted for making the hydraulic cylinder; metal dropped straight down from the runner box.*

happens, as was generally acceptable some years ago and is still far too often the case even nowadays.

Lessons from "Wasters"

The lecturer's own experience when starting up an electric steel foundry, from scratch, some 25 years ago and without the assistance of a metallurgist or any reliable technical data—or even any personal experience—was extremely worrying. It soon became very apparent that there must be an exhaustive inquest on every "waster," in order to arrive at the cause and to avoid the same in a "repeat," or similar job. By this means a waster was often more valuable than an apparently satisfactory casting, providing—and always providing—that a lesson was really learned.

The research, following some bitter experiences of those days, showed that the two principal causes of defects are (1) local hot-spots, caused at the injection areas of the ingates, and the resultant porosity through the impossibility of effectively feeding those areas, and (2) the failure to promote efficient general progressive directional solidification. Hence, the principle of ensuring that these two factors—so absolutely necessary in the production of sound, intricate steel castings—was applied to castings in all other alloys.

Briefly then, the theory and assertion remain that if these factors are adequately dealt with, and always providing that the melting technique and casting temperature be correct, plus normal good general practice, then a sound casting must result. Indeed, it can be said that if a faulty casting be made, unless it is one of very unusual design, then whoever has decided the method can rightly be blamed for inefficiency. Occasional accidents occur, but, apart from these, if there is a problem stated as to how to make a casting and the principles are understood and the essential points, which will be indicated, are

looked after, then it is asserted that a sound casting must result.

Crystal Cleavage

"Crystal cleavage" is a rather odd sort of term but probably intelligible to most foundrymen. The two top illustrations in Fig. 1 are halves of a 6 in. dia. blank flange—presumably, one of the simplest castings to make in the foundry. The percentage composition was 89 copper, 10 zinc and 1 tin; the latter being to give extra strength. In the old reciprocating-engine days, a ship was a network of steam pipes and there were many hundreds of flanges; it was then a favourite thing for the ships' staff to order blank flanges, as "stores," so that they could be fitted as needed when at sea. With the normal method of manufacture, numbers of these flanges fell into two pieces, when they were machined up on the outside edge and ⅛-in. was removed. A common term in the Navy for this defect was "sandwich metal," because it was of such common occurrence. The same problem is met with in the large flanges of up to about 12-in. dia., which were specified because uninformed engineers thought: "If we have a blank 12-in. dia. it can always be cut down to a 6-in. flange, or even smaller diameter, and it should be perfectly all right." Of course, crystal growth, causing cleavage, would then take place from both sides. All sorts of methods were tried out, years ago, such as smaller runners and bigger runners, etc., but the inevitable dendritic structure resulted when the job was made in sand moulds, and if chiselled around the edge the casting split into halves.

The example might be considered a rather simple one, but once crystal-cleavage splitting is overcome, then a lot of troubles in non-ferrous alloys have been mastered. The method of getting over the blank-flange trouble resolves itself into two expedients. One is to chill one side to make the grains grow solely from one face. As the metal cools, the crystals grow away from the surface through which the heat is conducted. To put chills on the bottom of every flange would be an enormous job because, normally, such moulds are made on a machine. If a flange be cast with a hole in the centre then the grains grow at right angles to that hole, as well as to the other surfaces so that, to a large extent, splitting is stopped. The second method to adopt—and for many years the lecturer has not had one such casting returned from the machine shop—is to insert copper nails around the mould, so that there are local centres of freezing and "crystal cleavage" is obviated.

Friction Plates

At a certain shipyard, there is a powerful cantilever crane which took contractors six months, in 1906, to get through its tests. It fell to the lecturer, in about 1928, to make new friction plates for it in phosphor-bronze. These were 2 ft. 6 in. dia., with a hole about 1 ft. dia., the thickness when finished machined being ½ in. They were cast ¾-in. thick and on being machined, the "crystal-cleavage" trouble was again encountered. On that occasion, chills were placed on one surface, but that proved to be a mistake because although it stopped splitting, there were localized dense spots which made the plates chatter as the brakes were applied. A complete chill made the surface far too hard; the metal would not "bind" when the brake was put on and slipping occurred. In the end, the method adopted was to make the mould, dry it thoroughly, and then on the day of cast, put fires on the bottom and make it really hot, at the pouring site. When the metal was ready for pouring, the top part—at room temperature—was quickly put on, the mould secured, and then poured at once, so as to get a modified chilling effect. Thus, there was one cold face and one hot face, and this stopped the cleavage, because the crystals were all growing from the cold surface. This method overcame the trouble and, as far as is known, those particular friction plates have never needed replacement. This example can be a very useful lesson to all non-ferrous founders.

Breaking While Hot

If gunmetal castings are broken up while hot, especially the larger ones, it is well worth the time examining the fractures, when it will be seen how the grains are growing to each surface and leaving a space, through the middle of the thicknesses. It is well remembered that during the war when there was a tin shortage and the modified brasses were tried for making pressure-tight castings, it was found that leakage was taking place from one end of a cast valve box, right through the whole body to the flange at the other end. On being broken while

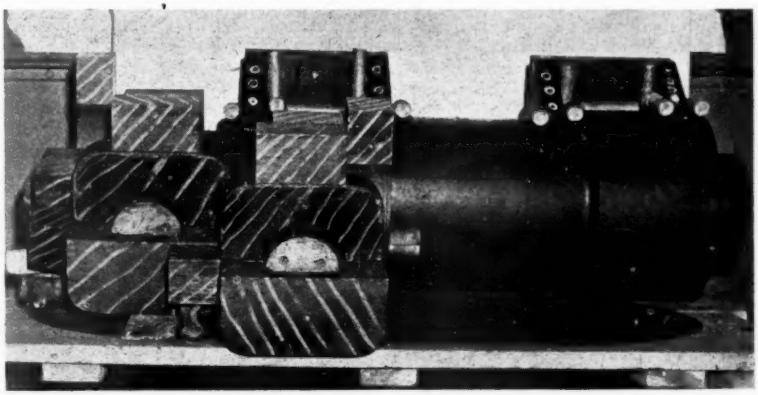


FIG. 4.—*Pattern for the hydraulic cylinder arranged on a workbench, with some of the chills in place.*

Foundry Problems and Principles

hot, it was clearly seen that end-to-end crystal cleavage was occurring.

The examples so far shown and discussed involve the first step in dealing with the general run of non-ferrous castings. Having more or less formed the basis of the lecturer's theory about the importance of controlling progressive directional solidification, suitable examples will be quoted.

Hydraulic Pump Cylinder

A hydraulic-pump cylinder is shown in Fig. 2, in which there were two fractures; it was made in cast iron and unable to stand up to severe frosts.

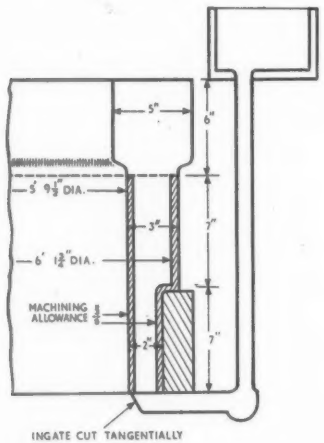


FIG. 6.—*Part section of a manganese-bronze bush, indicating the method of casting, running and feeding.*

It will be seen that this is the normal hydraulic-cylinder design for making in cast iron, because of the very heavy flanges and brackets. The matter of substitutes was so urgent that in the end, because of liability to fracture, it was asked if one could be made in gunmetal. It was agreed to undertake the job with the existing design, as there was no time to alter the pattern. (Sometimes it does so happen—a founder is given a pattern, made for production in cast iron, and has to produce the item in gunmetal.) This becomes therefore, one of the most striking cases of where there are extreme contrasts in heavy and light sections, not suitable for gunmetal, and in which the crystal-cleavage plane would be emphasized, because of the particular design. Only one way of tackling this particular job remained and that was to apply extensive knowledge of chilling in order to promote correct progressive directional solidification.

Fig. 3 shows another view of the job; against the surfaces of heavy sections cast-iron chills were placed. It has been found that, just as with cast steel, chilling is the answer to most of the problems concerning varying sections—either one must heavily chill from outside, or chill internally by using suitable "denseners." In this case, in addition to chills, copper rods were inserted to freeze the heavy brackets.

Fig. 4 is a view of the pattern on the bench with some of the chills in place. Experience in making steel castings, gives a new "slant" on all other alloys which will stand a considerable degree of chilling, excepting cast iron, where it is necessary to take much greater care. With all the non-ferrous alloys it will be found that chills, of this nature, can be used with great advantage.

The method which was finally adopted is shown in Fig. 5. The metal dropped straight down from

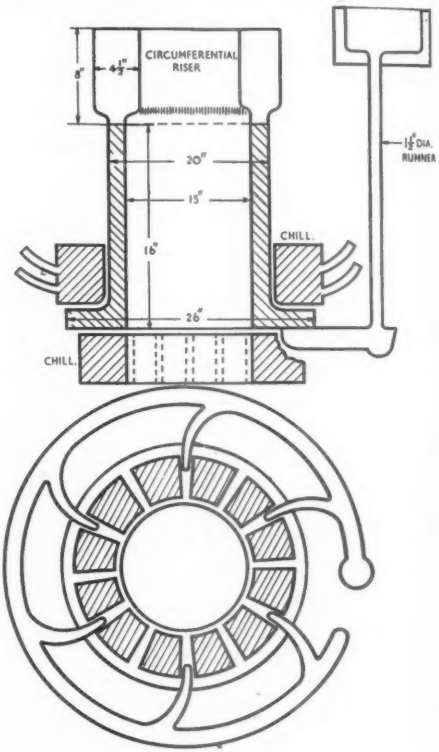


FIG. 7.—*Sectional sketch and plan of an aluminium-bronze bush 20-in. outside dia., showing method of running, chilling and feeding.*

the runner box. It was quickly chilled, at the bottom, the whole objective being that the metal, in falling, would avoid causing any hot spot, and then would be progressively frozen as the mould was being filled. Eventually, there would remain the feeder head and the hottest metal at the top—the absolute principle which must govern the production of all sound castings. It proved a most interesting job and the casting made has been in service for some years; 1,600 lb. per sq. in. is

the working pressure and the compositon selected was tin 12, zinc 3 per cent. and the balance, copper —really, a high-pressure-resisting gunmetal. The casting is working successfully and has shown no signs of any leakage of any kind; as radiographic examination proved it is a very sound casting, simply as a result of the method which was used in stimulating progressive directional solidification.

Manganese-bronze Bush

The manganese-bronze bush shown in Fig. 6 was quite a sizeable job—the finished dimensions being 6 ft. 1¼ in. o.d., 5 ft. 9½ in. i.d., which, with ⅜ in. machining allowance, brought it to a wall thickness of 3 in. at the top and 2 in. at the bottom. Its

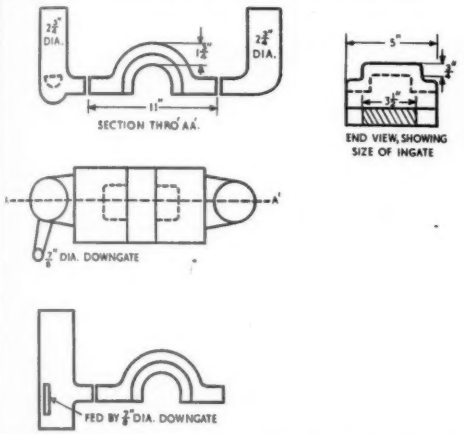


FIG. 8.—*Manganese-bronze half-bearings; made by the method shown in the lower illustration, using a whirlgate, all castings were sound (riser omitted). When made by other methods, all castings were sunken at the crown.*

height was 7 in. The feeder chosen was 6-in. high and 5-in. across, making a complete annular ring. A particular point to stress about this feeding ring is that it is set in 1 in. and out 1 in. so that the riser is 5-in. wide against a 3-in. section. If such a standard practice is fixed for risers, particularly for steel-castings, one cannot go far wrong and the moulders get used to it. There is a tendency for founders to take a riser straight up from a section, but there is always a risk of its freezing prematurely, particularly if all the metal flows upwards with the possible tendency for the temperature there to be not quite so high as the metal in the body of the mould. The firm which made this casting had never before tackled such a job, and yet the first casting produced turned out sound, further emphasizing the lecturer's views on progressive solidification.

Aluminium-bronze Bush

Fig. 7 shows an aluminium-bronze bush—20-in. o.d., 15-in. i.d., making a casting 2½-in. thick. This was a first replacement item in some foreign-produced machinery and was very urgently required. The method adopted was to place chills around the pattern, as shown in the illustration. To ensure progressive freezing—despite bottom injection of the metal into the mould (and in the case of aluminium-bronze this is considered essential) the heavy chills are fitted the whole way around. The method was adapted so as to give non-turbulent running and yet to avoid a localized hot-spot. In pouring, the metal came up very quietly indeed, and the job proved to be a sound casting. A circumferential riser was used of such dimensions as to ensure that it froze last and, in this case and also in the case of the manganese-bronze ring, once the metal had come up into the riser, the runner box, which was actually

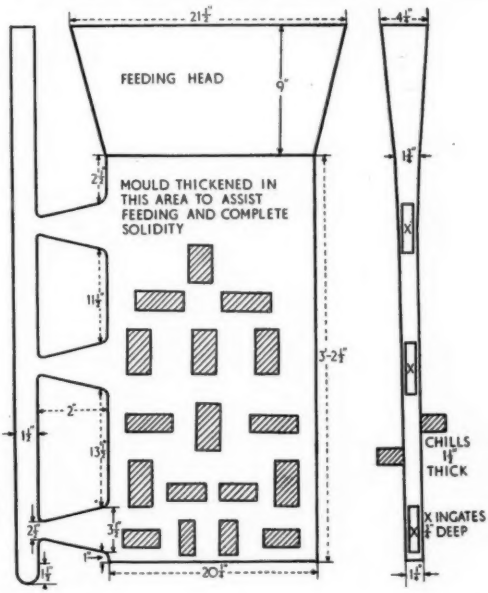


FIG. 9.—*Monel-metal evaporator-header coil-plate, showing foundry manufacturing method employed.*

arranged at the level of the top of the riser, was allowed to drain out completely. Then the " topping up " was done directly into the riser.

Bearing Cap

The casting shown in Fig. 8 appears to be a very simple sort of job to make in manganese-bronze—11-in. long by 5-in. wide—the sort of job which ought to readily go through a shop. Yet, without exception, these castings when in production were sunken at the top and gave a great deal of trouble. There was plenty of pressure and yet the metal was not being pushed up to the top of the bearing cap, so the whirlgate method of running was tried, and every casting so made was, or appeared to be, sound —quite an example of what the whirlgate can

Foundry Problems and Principles

achieve. When the whirlgate method was first advocated, the writer was very sceptical and only experiments convinced him that the method was satisfactory because, to all intents and purposes, it did not seem to be correct scientifically. For cast steel, also, the whirlgate method has proved very satisfactory. Although in the first place there seemed to be some very rigid rules about the sizes of the whirlgate and ingate, by experience one learns the

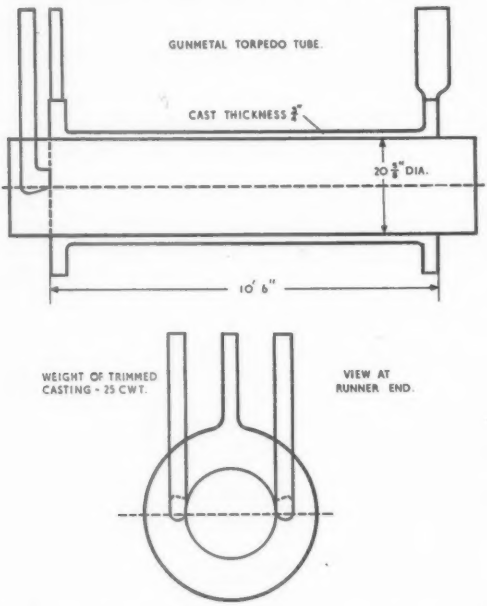


FIG. 10.—*Section of a gunmetal torpedo-tube, a number of which were subsequently built up to 30 ft.*

approximate sizes needed. In the illustration, the cross-sectional area is 1½ times the sectional area of the ingate entering the casting.

Monel Casting

A most interesting job (Fig. 9) arose during the war when there were some very urgent requirements and manufacturers were quoting very long deliveries for material. The particular item in mind was in Monel metal and a large number of holes had to be drilled in it. It has been said that it is impossible to cast one of these plates in Monel metal, but in times of crisis one will try the seemingly impossible. This job was to be in normal Monel, 68 per cent. nickel, and was cast by the method, as shown in Fig. 9. The size was 3 ft. 2 in. by 20¼ in. by 1¼ in. thick, and the casting had to be machined down to ⅞ in. thick, finished. It is contended that it is a very great mistake, unless there is some particular reason for it, to have the metal injection into a mould constricted—similar to that from a hose—because quietness of running has a great deal to do with a casting being satisfactory. A Monel-metal plate of this size cannot be adequately fed even by a complete lengthwise riser at the top, although the mould was thickened to make it wedge-shaped in section in order to promote downwards feeding. Cast-iron chills were scattered more or less in a pattern and on the opposite side they were staggered so that they did not come exactly opposite the others, the aim being to obtain a plate of equal density, generally.

Two of these plates were cast and both of them were satisfactory; the pouring temperature was 1,500 deg. C. and the weight of the metal 561 lb. The mould facing was of steel-moulding sand, which is very refractory and very permeable. The chills were 1½ in. thick and the ingates did not reach the full thickness of the plate but were ¾ in. wide and 3½ in. long, in each case. It was a most interesting job; it seemed that the only approach was to try to understand what was going to happen to the metal inside the mould in order to counter every adverse possibility. Whether the method adopted was the best possible is not known, but at all events both plates made were satisfactory despite the fact that numbers of holes had to be drilled in them and then a heavy pressure put on prior to use in superheated steam.

Torpedo-tube Castings

Fig. 10 shows a segment of a gunmetal torpedo tube. Just before the war the Admiralty decided to fit external torpedo tubes to each submarine alongside the conning tower in order to increase the armament. There was a run of 30 ft. altogether and three gunmetal lengths comprised the whole tube. However, when the first castings were sent to the machine-shop, it was found, although the bottom of the core remained straight there was sufficient bulge mid-way along the top of the tube to be in excess of the machining allowance and the castings had to be scrapped. Filing of the cores, from ¼ in., at mid-top centre reducing to nil at the ends had to be done in order to counter the bulging effect. There was a good deal of expansion on the core and this resulted in a curious top-centre bulging. In addition, several of the tubes showed signs of cracking along the top. Two or three were scrapped and a drilled-out section when broken in a vice, showed that the metal during casting was coming up both sides of the core, and the oxide skin at each side as the metal met at the top centre was preventing free mingling of the metal. What was thought to be a crack was, indeed, the result of the oxide skin preventing the intermixing of the metal. The founders had started by having two runners on the joint-line and on each side of the core. Another down-gate was then added, this leading into the top of the flange. In pouring, this runner was plugged until the metal was coming up towards the top of the core, when, on being lifted, such an inrush of metal along the top of the core was caused as to break the oxide skin as the metal flowed over the core. There were upwards of 350 of these castings made, following the alteration to the method of running, with not a failure amongst them. It was an experience which

taught a valuable lesson as, since the war, with the conversion of the old destroyers into the frigate class, it has been necessary to cast some very big pipes which are exceedingly thin. The method, in every case, has been to apply the additional runner,

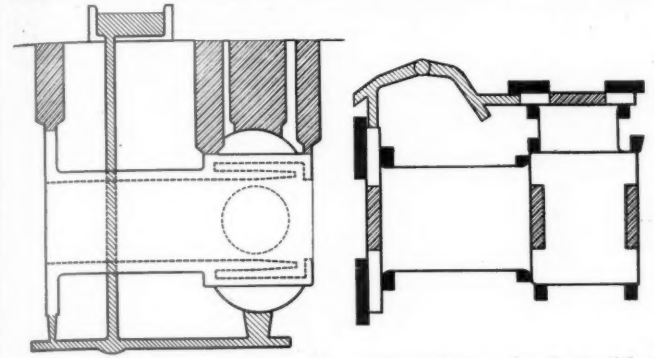


FIG. 11. — *Aluminium-bronze steam/acid injector pipe showing the method of chilling, running and risering adopted.*

and opening this after the mould was getting well towards full, in order to break the oxide skin. The weight of the castings shown was 25 cwt., large ones being 35 cwt.

Steam Injector-pipe

An aluminium-bronze steam/acid injector-pipe is shown in Fig. 11—vertical section and another view shows how the flanges were chilled. The runner was brought down to the bottom level of the casting and the ingates were very much larger than the main feeders so as to get a non-turbulent action of the metal entering the mould. It is shown how the bottom half of the flange had been built around with cast-iron chills and a riser put above it, to promote soundness. Aluminium-bronze is not an easy material to work with, and it has to be tackled in the right way in order to get a sound casting. An important point, of course, is that the moulds must be thoroughly dry; if there is any residual moisture at all there will be trouble. Also, there must be strict control of casting temperature.

Cast-iron Blocks for an Angle-bending Slab

In the case of a cast-iron angle-beading slab, Fig. 12, as machining would have cost a good deal of money it was necessary to make the castings almost to finished size; therefore one had to forget all about traditional or cheaper methods of moulding. Each of these castings had top and bottom faces formed of loam sand, which gave the parallel and level surfaces desired. Loam was used also for both the main cores and the 3-in. dia. holes. In a heavy casting with a general thickness of 3¼ in. there is a risk of quite serious metal penetration into the sand, hence the reason for these cores being made in loam. The small cores presented a special problem, as they also had to carry a heavy load. To render them serviceable, they were soaked in tar and then baked; the tar making them as hard as pieces of rock. The top part was bedded on to the main cores, by means of some soft loam, and this method solved the problem of producing these heavy blocks in such a way that they would fit snugly together, and in a level plane.

Burning-on

No doubt, many founders are conversant with the "burning" or "fusion" method of repairing castings in managanese-bronze, but perhaps not with cast iron. The special technique might interest members, particularly with regard to a difficult job, such as propellers (Fig. 13). It is possible to "burn" these up to a blade thickness of about 2¼ in. at the thickest part. The method is to make the joint, at about 4 in. above the level of the highest part of the cut edge and, evenually, cut out 2 in. for the flow-offs. To obtain success, in this particular case, it is necessary to cut off the damaged part of the blade at right angles to the centre-line of the blade. If attempts are made to cut it at an angle, cracks—caused by the stresses which are set up—will result.

The important feature about the "burning" of cast iron is that this metal, more than manganese-bronze or gunmetal, can be penetrated by salt water,

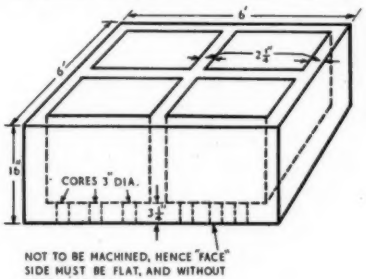


FIG. 12.—*Cast-iron blocks for forming a smithy angle slab, 60 of which were required.*

and unless the salt is removed, numerous gas holes will be found under the runner/riser. In the case of a propeller that is heavily penetrated with sea water, the remedy is to place the cut edge right into a coke fire and make it bright red hot. A day's treatment of that sort generally gets rid of all the salt-water absorption. The job is moulded in the

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traditional way, but, of course, a great deal more metal is needed, for the cast iron "burning," than for gunmetal and manganese-bronze (Fig. 14). The only way of checking the fusion is by using a dip rod. The method needs a great deal of experience to know exactly when to stop pouring and to stop-up the flow-offs, as excessive running through will

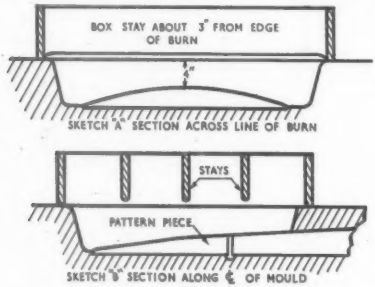
BOX STAY ABOUT 3" FROM EDGE OF BURN
4"
SKETCH 'A' SECTION ACROSS LINE OF BURN
STAYS
PATTERN PIECE
SKETCH 'B' SECTION ALONG ℄ OF MOULD

FIG. 13.—*"Burning-on" repair of a cast-iron propeller-tip using a pattern piece for the missing tip.*

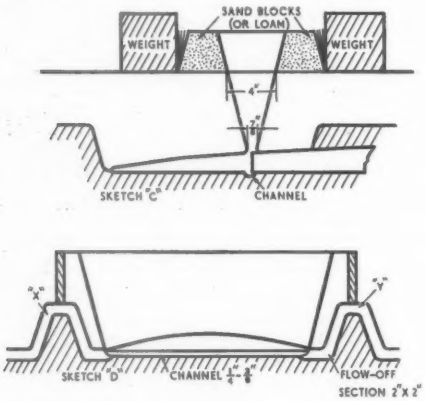

FIG. 14.—*Method adopted for the "burning-on" of a gunmetal or manganese-bronze propeller-tip.*

cause additional stresses and cracks. The first metal fills up the open mould, that is the new tip and the "burning" then proceeds, until the edge of the old blade is melted. Finally, when pouring stops, this original blade conducts away the heat and a sound joint results. It is the lecturer's experience that if the blade gets another knock at any time it usually breaks off somewhere else, and not in the same line as the weld.

Test-bars

Fig. 15 illustrates the old vexed question of making test-bars in 88/10/2 virgin gunmetal. With regard to directional solidification, if the centre of the bar is rammed up in a material which will act as a modified chill, then a sounder feeding will result. In this case, Zircosil material, was used as it is not only a very powerful refractory but, also a good conductor of heat. As it will be seen, it is possible to approach 24 tons per sq. in. tensile, which goes to show that the theory of always ensuring progressive directional solidification is a very valuable one and

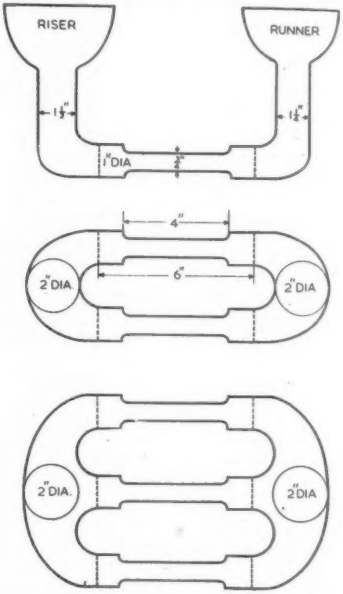

FIG. 15.—*Test-bar manufacture in* 80/10/2 *virgin gunmetal (first run) cast at* 1,170 *deg. C. Results were :*

Sketch.	U.T.S., tons per sq. in.	Elongation per cent.
Upper	15.0 15.0	13.5 12.5
Middle	21.0 21.0	38.0 38.5
Lower	21.4 22.6 21.2	40.0 50.0 37.5

should always be the founders objective. Zircosil material is expensive, but it gives excellent results and so is well worth the additional cost. Such excellent results cannot be obtained unless the melting method is correct. Melting must be carried out as quickly as possible and in a controlled atmosphere.

Fig. 16 demonstrates an experience in regard to the use of oil-sands for test-bars. A foundry in Scotland was making moulds, for test-blocks in oil sand and were getting results of 16 and 17 tons per sq. in. tensile. They seemed to have great difficulty in exceeding those figures, although as the results met the specification, they were not unduly worried. The lecturer carried out a few experi-

FIG. 16.—*Results of using oil-sand for test-blocks in 88/10/2 virgin gunmetal, cast at 1,170 deg. C.*

Type of mould.	First melt.		First re-melt.		Second re-melt.	
	Tensile, tons per sq. in.	Elongation, per cent.	Tensile, tons per sq. in.	Elongation, per cent.	Tensile, tons per sq. in.	Elongation, per cent.
Keel-type, in oil-sand ..	10.0	7.5	—	—	—	—
2-in. dia. runner and riser	19.4	30.0	21.8	42.5	20.4	53.0
Keel, in ord. sand ..	16.8	20.0	18.8	32.5	16.6	22.5
2-in. dia. runner and riser	20.8	36.0	19.4	26.5	18.2	32.5
Keel, in oil-sand	14.4	8.5	—	—	—	—
2-in. dia. runner and riser	19.2	27.5	—	—	—	—
Keel, in ord. sand ..	18.0	27.5	16.8	21.0	17.6	31.5

ments and by the first method the test-bars were all poured straight-away, as quickly as possible, and the result was 10 tons per sq. in. and 7.5 per cent. elongation. Pouring was commenced at a mould temperature of 100 deg. C. to 170 deg. C. Then a 2-in. dia. runner and riser with a downgate at the side was used and 19.4 and 30 per cent. respectively were the results obtained in ordinary sand. That seemed to indicate that the oil-sand was delaying the freezing and certainly in repeat tests of the same sort it was found that with oil-sand at the bottom, satisfactory results were not obtained.

Freight Charges to Rise

June 5 has been fixed as the date on which the British Transport Commission will introduce increased freight and passenger charges. Announcing the increases, the commission stated that they were necessary in consequence of the large increases in wages and salaries and of certain other increased costs. The National Coal Board states that coal prices will be raised from June 5 to cover the revised freight charges.

The BTC states that there will be a general increase of 7½ per cent. in charges for freight traffic by goods and passenger train, except as shown below. An increase of 15 per cent. will be made in charges for freight traffic in consignments of under 1 ton by goods train and for traffic by passenger train, other than perishables and traffic carried at the loaded van scale (*i.e.*, charged by the vanload), which will be increased by 7½ per cent. The higher percentage of increase reflects the relatively greater increases in cost of carrying small consignments.

Similar increases will be made in charges for railway collection and delivery service; in canal and dock charges, the increase will be 7½ per cent.

Total yield from these increases is estimated at £25,000,000 in a full year. This yield, says the BTC, will not bridge, by a wide margin, the gap caused by increases in wages and salaries already in operation. The commission is not, in fact, passing on to the public the full weight of these increased staff costs, as it intends that the industry itself shall make the substantial contributions necessary to close the gap, partly by continuing to increase its efficiency, and partly by improvements to be expected from other developments, such as the greater freedom to attract remunerative business under the freight charges scheme (submitted to the Transport Tribunal on March 21), and the effects of the railway modernization plan.

MR. JOBSON, chairman of Qualcast, Limited, is the latest company chief to sound a warning on the effect of rising prices in export markets. In an interim report to shareholders he states that increased costs have seriously affected the firm's export trade. Nevertheless, Mr. Jobson conveys that the year to next June promises to be a record one for the Qualcast group. Tonnage of castings, sales of finished products and wage bills are all at record levels.

British Oxygen Segregation Plan

A statement issued by the board of the British Oxygen Company, Limited, says the group is to complete the segregation of home operational activity under appropriate subsidiaries in order to leave the parent company free to concentrate on promotion of development and general guidance at home and overseas.

A new operating subsidiary, British Oxygen Gases, Limited, is to be formed as from October 1, 1955, with a first authorized share capital of £15,000,000, to undertake all trading operations in industrial and medical gases and equipment at present carried out by the parent concern. The existing chemicals division will be similarly formed into a new company, British Oxygen Chemicals, Limited, and arrangements are in hand for grouping BOC interests in electrode manufacture and electric welding processes, including activities at present carried out by the Quasi-Arc Company, Limited, and Fusarc, Limited.

In connection with the proposals it has been decided to appoint Mr. T. E. Potts, at present managing director of African Oxygen & Acetylene (Pty.), Limited, and Mr. J. Strong, at present managing director of Quasi-Arc and Fusarc, to the board of the parent company. Mr. Potts will also be chairman of the new British Oxygen Gases, and the electric welding division will be under the general direction of Mr. Strong.

Unique Blower at Margam Works

What is claimed to be the first steam-driven, axial-flow blast-furnace blower is soon to be installed in the new power-station near No. 4 blast furnace at the Margam (Glam) works of the Steel Company of Wales, Limited.

Built in Switzerland by Sulzer Bros., the turbo-blower will be capable of blowing a volume of 125,000 cub. ft. of air a minute at a maximum pressure of 35 lb. per sq. in.

The axial type of blower consists of a series of fan blades mounted on a single shaft, all of which blow in a forward direction along the line of the shaft. In this case it can blow at normal or at high top-pressure if necessary.

MR. P. H. TRUSCOTT has been appointed secretary of the Rio Tinto Company, Limited, iron-ore producers, etc., of London, E.C.3.

British Non-ferrous Metals Research Association

Thirty-fifth Annual Report

It is possible that the annual reports of the work of the British Non-ferrous Metals Research Association would be of added interest if instead of dividing the activities into "copper, nickel and other alloys; aluminium, magnesium and their alloys, lead, tin and their alloys," there was some sort of division into wrought and cast alloys—even as subheadings. The following extracts have been made of material germane to the foundry industry from the current report.

Shell Moulding

At the request of the Association of Bronze and Brass Founders, a member of the staff of the Liaison Department devoted several months to the study of shell moulding with particular reference to its applications in the non-ferrous industry, so that the Association would be in a position to give advice on shell-moulding problems. A report has been issued giving an unbiased picture of the present position of shell moulding as a foundry technique, which has filled a much-felt need and has been in great demand by members. Advice has already been given to a number of members who have sought help in applying shell moulding techniques to their own production, and it is contemplated that this service is likely to become increasingly in demand in the future.

Spectrographic Analysis

The main effort in recent years has been devoted to the analysis of copper and copper alloys for minor and major constituents by direct-reading spectroscopy and for the most part this work has been brought to a successful conclusion. The analysis for major constituents of copper alloys containing substantial quantities of lead is still unsatisfactory when solid electrodes are used, but solution techniques have been evolved which largely overcome the difficulty, although their use entails twice the time required for the solid electrode method and the results obtained are not yet as accurate as could be desired.

Co-operative work with members on the analysis of aluminium and lead alloys for major constituents continues to make good progress.

Physico-Chemical Methods of Analysis

A review of the present use of physico-chemical analytical techniques in the non-ferrous metals industry has led to the selection of a number of specific analytical problems which might be overcome by the application of such techniques and co-operative work is in hand to this end.

Mechanical Properties of Non-ferrous Alloys

Considerable progress has been made with the correlation of results obtained by an accelerated test and the conventional fatigue test. It seems possible that the accelerated test will provide a satisfactory means of rapidly exploring the effects of metallurgical condition and of other factors on the fatigue properties of the materials.

Copper, Nickel and their Alloys

The laboratory work on refractory materials for lining low-frequency induction furnaces has continued, but no refractory has yet been found which offers sufficient promise for practical trial in melting cupronickels, for which an improved lining is much needed.

The experimental work on the feeding of sand castings in alloys of long freezing range has been completed and the results have been reported. A critical review of the literature on the gating and feeding of castings has been made available to members, and experimental work is being undertaken in the laboratory to examine the claims made for various gating systems devised in the light of earlier work.

Properties of Complex Aluminium-bronzes

The study of the influence of composition and cooling rate on some of the properties of cast complex aluminium-bronzes has been completed. It has been shown that the mechanical properties of the slowly-cooled material in heavy-section castings can be explained satisfactorily in terms of structural changes consequent on slow cooling, modified in some cases by the influence of shrinkage or gas unsoundness.

Creep Properties of Gunmetals

This work continues but it is already apparent that restrictions on the use of one type of gunmetal at relatively high temperatures, because it was feared to be insufficiently resistant to creep, are not justified.

Aluminium, Magnesium and their Alloys

The influence of composition of the melt and of casting variables on the nature, size and distribution of intermetallics in cast high-strength aluminium alloys is being studied and the work to date has shown how the particle size of the intermetallics can be related to cooling conditions during casting. Through this it has been possible to explain certain features observed in the microstructure of large industrial rolling slabs and extrusion billets.

Corrosion

The mechanism of pitting corrosion of aluminium and aluminium alloys in supply waters has been studied in considerable detail and it is thought to be understood satisfactorily. Cladding with suitable coatings offers considerable promise and tests are still in progress to determine the life of such coatings in a variety of supply waters. Specimens of aluminium and aluminium alloys have been examined after burial in a variety of soils for two years, with and without a number of protective coatings, and the protection so far afforded has been good enough to warrant continuation of such tests without change in the schemes of protection, in the hope that the protective measures will be effective for much longer periods. Extensive work has been done in the laboratory to find the conditions to be observed in field tests of the value of sprayed coatings on certain aluminium alloys, and the field tests are now in progress.

Properties of Zinc-alloy Die-castings

A little work has been done during the year to explore the characteristics of zinc-base alloys with higher aluminium contents than are normally used in die-casting materials, in the hope that these might offer some advantages over the conventional type. The materials do not look promising and the work has been terminated.

Index to Vol. 97

The index to the JOURNAL, volume 97, covering the period July 1 to December 30, 1954, has now been printed and is available to readers free of charge. Applications for copies should be addressed to the publishing office, FOUNDRY TRADE JOURNAL, John Adam House, John Adam Street, Adelphi, London, W.C.2. Subscribers who wish to receive copies of indices automatically as they are printed may apply for inclusion on a permanent mailing list. Those already on this list should not need to apply for their current copy.

Notes from the Branches

London

At the annual general meeting of the London branch of the Institute of British Foundrymen held on Wednesday, April 27, with Mr. W. Wilson, president, in the Chair, the secretary, Mr. W. G. Mochrie, presented his report on the session activities. The following is an abstract from his remarks:—

Secretary's Report

During the past six years I have found the preparation of my annual report progressively easier and certainly more pleasant. This is not surprising, considering the higher volume and greater variety from which I can draw for its compilation. Unfortunately, restrictions imposed by length, require me to cut down much of the detail, but the crux of the year's work can be summarized thus:—

Technical:

The main branch has had eight technical meetings as follow:—September 29, "Casting of an Aluminium Wheel" by R. J. Harrison; October 20, "Cupola Developments" by E. Renshaw; November 17, "Some Foundry Problems" by J. Rogers; December 16, "Melting and Casting under Reduced Pressure" by Dr. H. H. Scholefield; January 26, "Melt-quality Tests—Nonferrous" by V. Kondic, A. R. French, and J. Wood; February 23, "Aspects of Metallurgical Control in the Modern Steel Foundry" by N. Y. Newton; March 30, "The CO_2 Process in the Jobbing Foundry" by A. Talbot; and April 27, Apprentices Meeting.

Attendances have increased by about 40 over last year, making about average 165 per meeting. The four sections of the branch also have had a full programme, East Anglia having had six meetings plus their annual general meeting; Slough six; Southampton six; Beds/Herts seven (plus their annual general meeting). Attendances at all the section meetings have been well above average and reflect the energy expended by the respective Councils and programme committees.

Apprentices Competition:

This year's president, Mr. W. Wilson, has always been well known in the branch as a champion of foundry apprentices. This has been further proved by his initiating the apprentices competition this year. There have been well over 100 entries, and the scale of this response must indicate the volume of work it has thrown on Mr. Frank Hudson, who has provided the detail, and on Mr. A. R. Parkes, who has acted as competition secretary.

Works Visits:

The branch for this year did not organize any works visits, but members continue to take advantage of those arranged on a national scale each year. At the International Conference and Congress scheduled in June in London, members will have ample opportunity of visiting foundries in this area at that time.

Continental:

Apart from the London branch invasion in Glasgow last June, and Mr. Parkes acting as London branch envoy to the Ardennes, no foreign visits were arranged during the session. Once the International Congress is off our hands, it is hoped to resume missions to the Continent.

Social:

Mr. A. R. Parkes rightly earned members' thanks for his organization of the dinner/dance in November. Once again it marked the official visit of the national president, this year Mr. John Bell, together with the national secretary, Mr. George Lambert, and his lady.

The "men-only" dinner in March was, as usual, an unqualified success; it is to be regretted that more members were disappointed this year because of the limitation on accommodation, but your committee is seeking "pastures new" for accommodation of a larger party next year.

Membership:

The following is a summary of the year's membership trends:—

Annual general meeting, 1954: subscribing firms, 33; members, 428; associate members, 345; associates, 99; total, 905. Annual general meeting, 1955: subscribing firms, 33; members, 459; associate members, 382; associates, 99; total, 973.

Subscriptions:

Subscriptions total £2,597 as compared with £2,378 received during 1953.

Awards and Distinctions to Members:

It will be recalled that at the annual general meeting last year I mentioned the fact that no national award had been gained by any member of the London branch. I am happy to record that we have made up the leeway, and last year, at the National Conference in June, the Oliver Stubbs medal was presented to Mr. E. Currie, past-president; the E. J. Fox medal to Mr. Frank W. Rowe, a well-known member of the branch; and the Meritorious Service medal to your honorary secretary. In addition, diplomas were awarded to the following London members for papers presented to the branch and elsewhere; namely, Mr. A. Emerson and Mr. J. Langham. The branch had further honour in that Mr. J. Langham's Paper was chosen as the Institute's official exchange paper for the International Conference in Italy. The national president designate this year is our own Dr. Everest, whom we hope to see elected as chairman of the International Conference in June.

General Council:

The usual four meetings have been well attended by branch representatives (at Glasgow, Birmingham, Derby, and York).

Next Session's Programme:

A committee has already been formed, and discussions will soon take place, concerning the details for next year's syllabus. Time will be devoted during the present meeting to enable members to make suggestions, and it is hoped they will give the matter serious thought.

International Congress:

Members will already be aware that the International Foundry Congress is scheduled for June 19 to 25 and application forms have already been circulated for completion and return to Manchester by May 21. Most of the functions have a capacity limit and as a very large influx from abroad is expected, there are sure to be disappointments. If these are to be reduced to a minimum, members' forms should be filled in and returned immediately.

National Secretary:

The Institute during the period suffered a grievous and sudden loss in the death of Mr. Tom Makemson, M.B.E., the secretary. Mr. George Lambert, who had previously devoted so much time and energy as his assistant, has since been elected to national secretaryship. He is well known in London and all will wish him every success.

Election of Officers:

It will be recalled that at the annual general meeting last year a new method was proposed and subsequently adopted with regard to the nominations of officers in the branch. This was put into practice this year in the form of a nominations circular, and I am aghast at the lack of interest taken by members as suggested by

Notes from the Branches

the paucity of the returns made to me. One reason that the London branch has gone from strength to strength in every way has, in my opinion, been due to the constructive criticisms of the majority of its members. That such a healthy body should deny itself the opportunity of fulfilling one of its most important functions—that of putting forward nominations for its officers—is beyond comprehension.

Under this heading, I must include what, to me, is the most serious item, namely, to inform members that I cannot offer myself for re-election as honorary secretary/treasurer for next year. Some members are already aware of the tragic circumstances that necessitate my spending most of my time at my firm's works in Birmingham. My experience during the past two or three weeks makes it abundantly clear that I shall be unable to devote the time necessary to do justice to the office in the branch which I have held for the last six years. Personally, this has come to me as a great blow, as I was looking forward—with your support—to a long term as servant of the branch. The last six years have given me tremendous enjoyment, having made so many good friends, having watched the register grow from 702 to around 1,000, the average attendance at the meeting being doubled, and having seen two more sections come under the aegis of the parent branch.

I hope to be forgiven if I close this chapter on a personal vein by thanking all the presidents under whom I have served, the members of the Council for their great forbearance, and particularly Mr. V. C. Faulkner who originally sponsored my application for membership of the IBF, who proposed my election to the Council, and again my nomination for secretaryship. I thank him most warmly for having introduced me to six most pleasurable years.

So long as the London branch secretary can have the support by the past-presidents, Council, and the body of members that I have had, so long will the London branch flourish.

Election of Officers

Continuing the official business of the evening, the next most important item was the election of officers. The president explained the position, *vis à vis* the new system (approved at the last annual general meeting) of nomination for election, which meant that proposers should hand in names at least 21 days before the annual meeting. The system had resulted in barely sufficient nominations to fill vacancies and it was hoped members would take more interest in the procedure next year. Mr. Wilson then read the names of those put forward for office in the branch, together with names of proposers and seconders: these being the only nominations permitted, their election was proceeded with. Elected for session 1955/56 as *president*, was Mr. F. Hudson, F.I.M.; as *senior vice-president*, Mr. M. Glenny; as *junior vice-president*, Mr. A. Talbot; as *members of Council* (to fill four vacancies), Mr. A. W. Bartlett, Mr. W. R. Buxton, Mr. J. Bain, and Mr. D. Morris; as *honorary auditors*, Mr. Barrington Hooper and Mr. V. Delport; as *honorary secretary/treasurer*, Mr. A. R. Parkes; as *social secretary*, Mr. W. R. Buxton. The *representatives to General Council* (Mr. Barrington Hooper, Mr. F. A. Wilson, Mr. M. Glenny, and Mr. L. G. Beresford); the *stewards* (Mr. E. H. Brown, Mr. G. C. Pierce, Mr. R. Pipes, Mr. A. Whiles and Mr. A. R. Wizard) and the *honorary lanternist* (Mr. P. Ellis) were all re-elected, and Mr. A. Talbot was chosen to serve as *branch representative to the Technical Council*.

On the president giving thanks to the members and Council for assistance during his year of office, this concluded the annual general meeting. Then followed consideration of the branch "Apprentices Competition" which was held during the session, the president awarding prizes and diplomas. (This part of the proceedings was reported in the JOURNAL, May 5.)

Newcastle-upon-Tyne

At the annual general meeting of the Newcastle-upon-Tyne branch of the Institute, held in the Neville Hall, Newcastle-upon-Tyne, on April 2, with Mr. C. W. Stewart, the branch president, in the chair, the annual report, covering both the secretarial and financial sides of the branch's actitivies, was presented and approved. Nominations were then received for the various offices rendered vacant and the following officers elected for the 1955-56 session: As *president*, Mr. C. Nicholls; *senior vice-president*, Mr. J. T. Fletcher; *junior vice-president*, Mr. M. M. Hodgson; *hon. secretary*, Mr. F. Robinson; *members of Council*, Mr. J. G. Dodds, Mr. W. S. Paulin, Mr. J. C. Robinson, Mr. D. Worth, Mr. E. Charlton, and Mr. W. Stewart.

Following the election of officers, an announcement was made by the secretary in connection with the junior section of the "John Surtees Memorial" competition. The examiners commented on the high quality of the results and of their difficulty in making the award, which was won by Mr. F. A. Askew, with a special commendation for Mr. R. Kennedy.

Exothermic Feeding Heads for Non-ferrous Work

After the business meeting, a short Paper under the above title was given by Mr. W. Stewart, a member of the branch, in which he emphasized the advantage of special cups, made from exothermic material, to form feeder heads for many types of castings made in the non-ferrous foundry. The high degree of shrinkage of a number of non-ferrous composition alloys, such as high-tensile brass, aluminium-bronze, etc., necessitated adequate feeder heads to ensure that castings in these materials would be properly fed with hot metal. Normally, large heads are necessary, but, by using exothermic cups, the size of the heads can be substantially reduced, sometimes to a third normal size, which is an important economic aspect with to-day's prices of non-ferrous metals.

The feeding cups Mr. Stewart illustrated on a screen were necked, so that the actual contact with the casting is relatively small and the head is easily broken from the casting after it has cooled, but the amount of heat supplied by the cups is ample to keep the metal in a fluid condition long enough to ensure adequate feeding. The cups are made from a mixture of the exothermic material with just sufficient water to make the material workable, moulded in special boxes to define the shape, and subsequently baked. The bottom of each cup almost invariably forms part of the mould and is coated with plumbago. After the initial experimental stage, Mr. Stewart reported that he has had no difficulty in applying these exothermic cups as feeders and the results have been all that could be desired. Graphs were shown to provide a guide to the thickness of cup in relation to the size of the head used. After some discussion, Mr. Stewart was thanked for the presentation of his Paper, and the meeting concluded with a word of appreciation for the retiring president, Mr. C. W. Stewart, proposed by Mr. Ellis, for his excellent service to the branch throughout the session. Mr. Stewart thanked members for their support, particularly the secretary and the members of the branch Council.

Bristol and West of England

The annual general meeting of the Bristol and West of England branch of the Institute of British Foundrymen took place at the Grand Hotel, Bristol, on April 30, the branch president, Mr. H. V. Heath, being in the chair. Presenting his annual report, Mr. G. W. Brown, the branch hon. secretary, said that the previous year had been quite a satisfactory one, during which the average attendance at meetings had been 45. The visits to British Railways works and to Stothert and Pitt of Bath, had proved very popular, and a meeting held at Exeter in conjunction with the Exeter and Devon Productivity Council, at which Mr. Taylor had given his talk on the "Production of Large Steel Castings" had been a great success.

On October 7 of this year, the branch would be the hosts for National Works Visit Day, and an attractive programme had been arranged for the visitors, and the secretary also reported the full lecture programme for next session. Branch membership continued to remain at approximately the 150 level. In this connection, there was a suggestion that more interest was being taken in branch activities by many people who might be attracted to membership. Five officers of the branch had been honoured with invitations to take the Chair at a series of lectures on "Mould Materials" which was now being given at the Bristol College of Technology.

MR. HEATH said he felt that the secretary's report was a very satisfactory one, the contents of which would no doubt meet with the approval of all branch members.

MR. D. P. WILLIAMS, junior vice-president, said he felt certain that all present would like to express thanks to the secretary for all the work undertaken on behalf of the branch during the past year, including the arrangements for the annual dinner, which proved such a success, and was attended by the national president, Mr. John Bell; Mr. and Mrs. Lambert; Mr. and Mrs. Wall (representing the Wales and Monmouth branch); representatives of the Bristol Engineering Manufacturers' Association, and of the Institution of Production Engineers.

MR. G. W. BROWN presented his report as branch representative on the Technical Council, after which the election of officers for 1955-1956 was made; the following were appointed:—As *branch president*, Mr. D. A. Richards; *senior vice-president*, Mr. D. P. Williams; *junior vice-president*, Mr. H. B. Dauncey; *hon. secretary*, Mr. G. W. Brown; *representative to General Council*, Mr. D. F. B. Tedds; *representative to Technical Council*, Mr. G. W. Brown, and *hon. branch auditors*, Mr. J. R. Hayward and Mr. D. F. B. Tedds. Mr. L. Gabb and Mr. L. Freeman were elected to fill vacancies on the branch Council.

Southampton

At the annual general meeting of the Southampton section of the London branch of the Institute of British Foundrymen, held on April 28, the conclusion of a satisfactory and progressive session was reported by the secretary, Dr. O. P. Einerl. The following were elected or confirmed in office for the next session: As *president*, Mr. W. W. Edwards; *senior vice-president*, Mr. G. J. Rogers; *junior vice-president*, Mr. M. A. Bachelor; *honorary secretary*, Dr. O. P. Einerl; *honorary treasurer*, Mr. L. H. Grainger, and as *members of Council*, Mr. W. McBride, Mr. H. W. Davis, Mr. Grainger, Mr. R. J. Leonard, Mr. A. Prince and Mr. P. B. Walters.

BRITISH INSULATED CALLENDER'S CABLES, LIMITED, announce that MR. H. THOMSON has been appointed manager of their Glasgow branch.

BIF Functions

At one of the official luncheons at the Castle Bromwich section of the British Industries Fair, Dr. D. J. Muir, Agent-General for Queensland, said that he did not think the current import restrictions to Australia would continue "for any great length of time" and that however much the Australian secondary industries expanded, the rising population would create an increasing demand. Australia would continue to turn to Britain to satisfy it. He insisted that Australians buy in the British market not for sentimental reasons, but because they know the quality of goods is high and if that quality is maintained and if there is reasonable delivery the orders would continue to be placed in this country.

Mr. Arthur Keats, Midland-area chairman of the Engineering Industries' Association, appealed to manufacturers to give export orders priority of delivery. He predicted that British manufacturers could do the overseas business that the nation needed for its economic stability.

On May 5, members of the National Brass Foundry Association, the National Federation of Ironmongers and the Federation of Hand Tool Manufacturers were entertained at the official luncheon, it being "Hardware Day." Welcoming them, Mr. E. M. Clayson, senior vice-president of the Birmingham Chamber of Commerce, said that reports from overseas buyers were highly satisfactory.

Mr. A. R. W. Low, Minister of State at the Board of Trade, said that in an hour-and-a-half of touring the Fair at Castle Bromwich the words "steel shortage" were not mentioned to him once. On the other hand, he had several times heard the words "order books are bursting their covers."

Census of Production for 1956

The Census of Production to be taken in 1957 for the year 1956 will be a simplified census taken on a sample basis, similar to the Census for 1955. This decision has been made after consultation with the Census of Production Advisory Committee and is in accordance with the programme of censuses recommended by the "Verdon Smith" Committee on the Censuses of Production and Distribution

The statutory form of return for the larger establishments will be a simplified one and the questions to be covered will be identical to those asked for the 1955 Census. Smaller firms with fewer than eleven employees will be required to state only the nature of their business and the number of persons employed, except in a few trades in which, because of their importance, they will be asked a few additional questions, as for the Census for 1955. The trades covered by the 1956 Census will be the same as those included in the 1955 Census, *i.e.*, mining and quarrying, the manufacturing trades, building and contracting, and gas, electricity, and water.

The method of sampling will be similar to that used for the 1955 Census. A stratified sample will be selected for each trade or group of trades, the sampling fractions being varied according to the number of establishments in the trade and their size distribution. Only a proportion of establishments, as in 1955, therefore, will be required to make returns. Firms that are selected for inclusion in the sample will be advised in the autumn of 1955; they will be sent an advance copy of the form to enable them to arrange their records accordingly.

Prospects for Industry

In his presidential address at the annual meeting of the Birmingham Chamber of Commerce recently Mr. J. Ivan Yates said that the latest developments of an age of phenomenal scientific and industrial progress, among them automation, nuclear energy and electronics, held out to industry the promise of a brilliant future. With employment at record levels, rising industrial production, and increasing investment in factory buildings and plant, industry had demonstrated its confidence in the future and in the policy of a free and expanding economy.

The deterioration in the terms of trade which Britain had to face might be maintained if the expansion in the United States economy continued during 1955, because the increase of American industrial production would stimulate the demand in world markets for primary products. Yet the higher earnings of the main raw material producing countries should lead to an increase in their imports. Mr. Yates said that he was hopeful that the new series of import restrictions in Australia would prove to be temporary.

Whether Britain was able to balance her payments depended on whether British exports remained competitive in world markets and on a greater proportion of the nation's production being exported. The accounts of the Chamber were presented by Mr. E. M. Clayson, the vice-president, who said that although the surplus on the year's working had fallen the balance sheet presented "a position of great strength."

US Steel Industry's Output Record

The United States steel industry is reported a week ago to have broken its Korean war production record, producing 2,328,800 net tons of ingots and castings. The previous weekly record, set up in the week of March 29, 1953, was 2,324,000 net tons.

Operations at US steel mills last week were scheduled at 96.7 per cent. of rated capacity, with production at 2,334,000 tons, according to the American Iron and Steel Institute. This compares with the previous week's revised figures of 96.6 per cent. and 2,331,000 tons, and with 70.9 per cent. and 1,690,000 tons in the corresponding week last year.

The index of ingot production last week was placed at 145.3 per cent., against the previous week's revised figure of 145.1 per cent., and compares with 105.2 per cent. in the corresponding period a year ago.

LCC Seeks Steel Tender Inquiry

It has been decided by London County Council to bring to the attention of the Government, with a recommendation that it is brought before the Monopolies Commission, the question of 10 tenders for the supply and delivery of steelwork for the completion of the north block of the new County Council offices behind County Hall, which all amounted to the same figure.

The Establishment Committee of the London County Council has decided in favour of the award to the South Durham Steel & Iron Company, Limited, of a contract for the supply and erection of the steelwork required to complete the new north block of the County Hall.

JOHN HUDSON & COMPANY, LIMITED—Mr. John Wilfred Carmichael has been appointed deputy chairman of the company. He has also been appointed deputy chairman of Samuel Williams & Sons, Limited, and the Hudson Steamship Company, Limited.

ECSC Production Tax Reduced

The High Authority of the European Coal and Steel Community has announced a reduction in its tax on coal and steel production in the Community from 0.9 per cent. to 0.7 from July 1. The levy is used for administrative costs, for sponsoring research, and to build up a loan fund for community industries. The High Authority's guarantee fund from the levy is at present worth about $75,000,000.

The Community's Common Assembly was, however, split over the High Authority's decision to reduce the levy, which, it is estimated, will cut the organization's income by half. A resolution was tabled by M. Guy Mollet, of France, protesting against the decision.

Members of the Common Assembly have also held discussions on the creation of a working group to study the possibility of the Community embracing other matters beyond the present common market it governs for coal, steel, iron ore, and scrap. The Assembly adopted a provisional plan for the expenditure of about £489,000 in the financial year 1955-56.

Foreign Ministers of the Community nations will meet on June 1 to name a new president of the High Authority to succeed M. Jean Monnet.

Iron-ore Imports

Iron-ore imports in March, and the total for the first quarter of this year compared with the corresponding period of 1954, are shown below.

	Month ended March 31.	Three months ended March 31.	
	1955.	1954.	1955.
	Tons.	Tons.	Tons.
Sierra Leone	79,465	162,039	153,900
Canada	—	140,367	80,011
Other Commonwealth countries and Eire	1,961	13,677	4,500
Sweden	271,416	999,452	843,836
France	65,338	123,568	148,079
Spain	47,261	116,559	144,991
Algeria	222,711	509,271	532,421
Tunisia	40,190	117,226	148,664
French Morocco	17,570	86,157	60,876
French West Africa	44,604	140,758	111,125
Spanish Morocco	11,130	67,157	40,730
Liberia	18,250	44,959	66,411
Brazil	38,035	99,185	81,615
Other foreign countries	27,103	87,680	60,672
TOTAL	885,034	2,708,055	2,477,831

Aluminium Supplies Safeguarded

An agreement concluded between the Aluminium Union, Limited—the sales subsidiary in the UK of Aluminium, Limited—and the Aluminium Industry Council will serve to safeguard the production of aluminium castings to meet rising demands from the vehicles, electrical, domestic appliance, and other industries. It has been agreed by the Aluminium Union to make available immediately additional and appreciable quantities of virgin aluminium to the secondary smelting industry.

This action, the council says, will permit all the requirements of the foundries, and in turn of their customers (many of whom are important in the export sphere) to be met.

Blast-furnace Design and Refractory Wear

German Experience with Carbon-block Linings which points a Number of Parallel Applications to Foundry Furnaces

The use of carbon blocks for the linings of blast-furnace stacks and hearths has been practised in Germany over a lengthy period. More recently, successful experimental trials have been carried out by blast-furnace operators in this country, although perhaps partly due to differences in furnace design and in composition of the charge results here and on the Continent, or indeed in the United States, where carbon is widely employed, have not been uniform. The subject is referred to in two papers presented at a meeting of the *Verein Deutscher Eisenhüttenleute,* and described in *Stahl und Eisen* for December 16, 1954. The first deals with the correlation between furnace design and wear of refractory lining in the blast furnace by H. Kahlhöfer and A. Send, the second with destruction phenomena of the refractory lining of a blown-out blast furnace, by the two authors already mentioned and W. Himsel. Both contributions relate in particular to No. III blast furnace at the Mannesmann Works, Hückingen, in the Ruhr, one being concerned with correlating the original design of this furnace with refractory wear, while the other paper is confined to discussion of the destructive phenomena which partially destroyed the lining.

Correlation between Design and Wear

The four blast furnaces, Nos. I to IV, of the Mannesmann works at Hückingen are very similar to American design except that the furnace tops and skip hoists are separately supported. When No. II was rebuilt, the furnace shell was isolated from the main structure and welded throughout. The characteristic features of this new design are easy accessibility at the junction of stack and bosh due to the absence of the stack supporting ring and small stack-wall thickness of 1 ft. 8in. which is completely water-cooled. The general practice at the Mannesmann works has always been, to insert cast-iron coolers in the entire stack lining. The throat of this furnace consisted of basic-Bessemer iron. Carbon bricks were used for the hearth, side-walls and bosh, carbon paste with a 14 per cent. tar content being rammed in the 3-in. gap between the shell and the brickwork. Use of fire-clay bricks was limited to the tap-hole.

It was found at Hückingen and also at other blast-furnace plants in Germany that after only a few weeks' operation the inner portion of the thick stack lining of orthodox furnace design had either spalled off or eroded away until the cooling elements had been exposed. Thus, the lining had become irregular in contour and porous and offered little resistance to penetration of the furnace gases. It was, therefore, decided at Hückingen to resort to a stack lining of a very much reduced thickness. As, however, right from the beginning of the furnace campaign the heat losses from the stack of the modified furnace were relatively high when normal basic-Bessemer iron was made, it was decided to build the lining of No. III furnace with a thickness of 2 ft. 4 in. to reduce the heat losses in the first years of operation.

Bosh Wear on Carbon Blocks

Contrary to British experience, the carbon blocks built in the bosh of several furnaces at Hückingen had not remained intact during the furnace campaign but had suffered initially heavy wear until the exterior spray cooling became effective. Two protective layers of slag and ore-coke mixture respectively were by then deposited in the carbon which stopped further wear. This type of bosh wear, however, is most undesirable with a furnace carrying its own weight, because the stack brickwork ceases to give the necessary support. Trouble due to movement of the two bottom rows of cooling elements was indeed experienced on No. II blast furnace after a campaign of only 18 months. The cast-iron coolers were replaced by steel-plate coolers, since these had proved very successful as an emergency measure during the war. The high heat conductivity of these new elements proved invaluable in this instance, because a coke-ore protection layer was soon formed in the weak area. No. III blast furnace which had been in operation for 16½ years and had produced almost 3,000,000 tons of basic-Bessemer iron never gave trouble near the entablature although the stack brickwork had suffered very heavy wear. The furnace still produced good iron at the end of its life, but coke consumption was high. It is probably advisable for economic reasons, state the authors, to reline a blast furnace after a make of 2,000,000 tons. As no stack bricks of the American super duty type are available in Germany it might well be that longer stack lives would be obtained by the development of similar bricks. The average porosity of German stack bricks is of the order of 20 per cent.

Although carbon ramming materials have given excellent results in many German furnaces, carbon blocks are favoured. The use of carbon material or carbon bricks, however, does not prevent salamander formation. Generally, a salamander of several hundred tons is formed by the end of a long campaign. Theories about the disappearance of carbon blocks in the centre of the hearth have been advanced by several workers. It is, however, the authors' opinion that when iron in the unsaturated state comes into contact with carbon at temperatures of from 1,400 to 1,600 deg. C., it will take up carbon. R. Klesper found that basic-bessemer iron with 3.5 per cent. carbon picked up 1 per cent. of carbon when fused in a carbon crucible under vacuum. The Mannesmann Research Department carried out similar tests, which confirmed Klesper's

findings. In spite of this undesirable wear of carbon blocks the use of carbon in the hearth is still preferred to fireclay bricks. The installation of cooling elements under the hearth of a furnace seems to be the only possible way of eliminating salamander formation.

Metal Slivers in Carbon-lining Joints

The presence of metal slivers in the joints of the outer carbon lining of No. III furnace after it had been shut down for nearly seven months remains unexplained. According to B. Wieland a salamander of about 16 ft. dia. has a linear expansion of ¼ in. at 960 deg. C. If a furnace is shut down for a long period as was the case with No. III, a volume shrinkage of the salamander and the lining will take place and the joints in that portion adjacent to the salamander will open. On starting up again, the salamander will expand, and heat up more quickly than the carbon blocks, allowing more metal to enter the joints. The pressure which these metal slivers exercise on the lining will open the joints further and allow further penetration, thus accounting for the formation of layers in the slivers. The shrinkage of carbon blocks after long service is also unexplained. Unused German carbon blocks expand, on refiring between 20 deg. C. and 1,000 deg. C., up to 0.65 per cent. In the region of 1,000 to 1,300 deg. C. their volume is stable; then on further refiring they begin to shrink by from 0.36 to 0.64 per cent. depending on the raw material used and on their texture. According to G. D. Elliot, British carbon blocks shrink 1 per cent. when refired at 1,500 deg. C. for 2 hrs.

From these observations, state the authors, it follows that a long shut-down can lead to hearth breakouts, and when blowing-in it would be advisable to make a pig-iron of high viscosity, such as hematite iron of high silicon content, which would enter the joints and soon freeze and thus prevent further penetration.

Carbon-block Strips in Lower Stack

In the course of discussion on this paper W. Wolf underlined the experience of Westfalenhütte at Dortmund with carbon-block strips in the lower shaft of two of their blast furnaces. During a stack rebuild of No. I furnace a continuous strip of carbon blocks about 5 ft. high was built 3 ft. 3 in. above the lintel. After the furnace had been in service for a week, the carbon blocks started to expand considerably and the bolts which fastened the stack bands fractured and had to be replaced by larger ones. At the same time alkali cyanide began to exude through the joints. Holes were drilled into that portion of the stack and at a depth of 10 in. The alkali content of the samples varied from 6.7 to 12.8 per cent. while at a depth of 1 ft. 7 in. the samples showed only 0.59 to 2.95 per cent. alkali. The outside brickwork was then covered with refractory cement and the flow of alkali-cyanide through the joints ceased. After about a year, the expansion of the carbon gradually diminished and finally ceased. The furnace was kept in operation for a further 1¾ years. No deposits were noticed on the carbon brickwork of the stack, although occasionally the fireclay portion above accumulated deposits. When this furnace was blown-out an examination of the carbon stack bricks revealed that half the thickness of the original lining was still in good condition whereas the inner half had become fissured and a hard slag skin had formed on the inside. The fireclay bricks above had been similarly attacked to the same extent, in spite of the cooling boxes.

The use of carbon was continued in the stack of No. IV furnace, which is also banded. In this instance the carbon blocks were covered on the outside with a steelplate and the gap filled with carbon paste. Provision was made for measuring the lateral expansion.. During the first month of operation the expansion of the blocks was considerable and then ceased. When the plating was removed after six weeks a striking increase of joint thickness was observed, indicating that the inside layers of the carbon blocks must have undergone considerable volume increase, whereas the outside had remained unchanged. Holes were drilled through the blocks and examination of the samples showed that the expansion was mainly due to alkali absorption. Thus the two findings were that carbon blocks when used in the lower portion of the stack remained free from deposits for three years, and further, that they had not been attacked more deeply than the fireclay bricks.

Destruction Phenomena

Discussing more fully the destruction phenomena of the refractory, the two authors of the preceding paper and W. Himsel state that the stack brickwork had completely disappeared above 36 ft. and was also missing in many other places. This heavy wear was caused by mechanical abrasion of the descending burden and of the ascending furnace gas. This type of attack is often aggravated by alkali penetration and carbon deposition in the brickwork. Chemical analyses of the scabby deposits on the stack lining showed that the lime/silica ratio varied from 1.2 to 1. The ferrous oxide content was higher in the deposits than in the slag, whereas manganese oxide, alumina and magnesia were present in about the same proportions as in the end slag. The excessive alkali content of these scabs was due to their high vapour pressure. At a stack height of from 8 to 16 ft. the main damage was done by indirect reduction, reflected in the high metallic iron and carbon content of the scabs. The high carbon content of the upper stack deposits was closely associated with the zinc and zinc oxide deposits No further deposits were found on the brickwork above 34 ft. stack height.

Bosh Section and Hearth

In the bosh section, the refractories are subjected to heavy attack by a very fluid slag. The carbon blocks in this section had suffered initially heavy wear until the outside cooling became effective. Reaction between carbon and slag ceased when the thickness of the brickwork had reached between

4 and 6 in. The remaining carbon blocks showed cracks and infiltrations. These cracks might be due to carbon deposition, but are mainly ascribed to the leaching-out of alkalis by the humidity of the air. The high alkali content of the bosh samples showed that alkali-oxide vapours possess excellent diffusibility, enabling them to penetrate the pores of a strongly cooled brickwork. The high zinc content of one sample, in the region of 20 per cent., taken about 6 ft. 6 in. above the tuyere is difficult to explain. The sample also contained 29 per cent. alkali oxide.

The carbon blocks of the hearth were found to be in good condition up to tuyere level. Above the tuyeres, however, destruction of the carbon blocks was caused by water and subsequent oxidation. The results of the physical and chemical examination, carried out on hearth and side-wall bricks, showed that although high carbon content and low porosity are necessary pre-conditions for good brick strength, other factors must also affect the strength of the bricks and their behaviour in service. All samples except four had a greater cold crushing strength than new bricks, in some instances reaching 100 per cent. excess. This increased strength might be due to the filling of the pores and the tension set up in the texture, which had also caused cracks.

Salamander Composition

The analyses of samples taken from the salamander showed all the usual constituents present in pig-iron. The elements carbon, silicon, manganese and phosphorus were, however, present in quantities which were below those of the metal. This indicated that segregation had taken place in the salamander by gravity. The sulphur content of the samples was strikingly high, yet owing to its low diffusibility, it must have been subject to gravity diffusion just as carbon and phosphorus. The high fusion point of manganese sulphide is, however, held responsible for its low segregating power. The microscopical sections of the samples of the salamander showed a pearlitic ground mass with manganese sulphide inclusions along the edges of which graphitic carbon, surrounded by ferrite, had been deposited. This indicated that the salamander had cooled down very slowly. Ledeburite and graphite were only present in small quantities, while primary cementite was found in one micro-section. From the microscopical examination it can be concluded that the salamander consisted of a steel-like iron-carbon alloy.

Although the metal slivers which were found in the joints of the carbon-hearth brickwork differ widely in their chemical composition and in their microstructures, there can be no doubt that they originate from the salamander. As the elements silicon, manganese, sulphur and titanium, which are often present in greater quantities in the salamander than in the metal, considerably reduce the melting point of pig-iron, they penetrate the joints of the lining and even enter the texture of the carbon blocks as veins.

Blown-out Blast-furnace Linings

Survey of Brickwork Examination

For many years it has been the practice of the British Ceramic Research Association to examine the brickwork of blown-out blast furnaces and to report the findings together with data regarding the furnace campaigns to the Blast Furnace Refractories Joint Committee of BISRA and the British Ceramic Research Association. The Iron and Steel Institute Special Report No. 51, entitled " A Survey of the Results of the Examination of the Brickwork of Blown-out Blast Furnaces," by H. M. Richardson and Dr. G. R. Rigby, gives data on 79 blown-out furnaces at different plants, examined over the last 20 years. The findings have been assembled and tabulated and form a basis for comparing the various modes of deterioration of brickwork from the top of the stack to the hearth. Of the furnaces blown-out, stack-failure accounted for nine, hearth-weakness or breakouts for 13, and 14 were worn-out or had become too uneconomical to warrant further blowing; 33 furnaces were blown-out according to schedule or because of shortage of ores. The reasons for the blowing-out of the remaining ten of the furnaces in question were not recorded.

General consideration of the conditions of the refractories in each of these cases is given in a number of tables. The relation between furnace design and operation and the performance of the brickwork lining is reviewed, and certain suggestions are put forward. A single off-take system is discouraged, since it leads to channelling of the gases and subsequent erosion. Even a multiple off-take system should be carefully planned in relation to the dust-catcher to induce an even gas-flow up the stack and a consequent reduction in localized wear.

The practice of employing banded boshes as opposed to plated construction is discussed, together with the inadvisability of siting tuyeres directly above the tap-hole or slagnotch. The survey concludes with a note of warning against assuming that the rate of rise of the lining temperature is of no importance. Although examples of long subsequent campaigns can be cited in favour of a rapid blowing-in schedule, there is abundant evidence to show that sudden temperature rises can cause irreparable damage to the refractory lining. The detailed tables included in the survey extend over 23 pages. Copies may be obtained from the British Iron and Steel Research Association, 11, Park Lane, London, W.1 (15s. to members of the Iron and Steel Institute, 25s. to others).

CAMBRIDGE UNIVERSITY has been offered by Imperial Chemical Industries, Limited, a grant of £1.000 a year for five years to be spent on research relating to the growth of crystals and the mechanical properties of metals. The British Oxygen Company, Limited, has offered to renew for a further period of seven years the deed of convenant under which it has made a donation at the rate of £500 a year for work in the Department of Physics in the field of low temperatures.

Settlement of Industrial Differences

From the beginning of 1952 till the end of April, 1955, 1,019 awards were issued by arbitration bodies appointed by the Minister of Labour. In the same period 10 reports of courts of enquiry and six reports of committees of investigation were made in connection with actual or threatened disputes, and helped to promote a settlement. These details, supplied at Question Time in the House of Commons by Mr. Harold Watkinson, Parliamentary Secretary to the Ministry of Labour, were prefaced by the comment that arbitration proceedings aimed to provide a peaceful means for the settlement of differences rather than to bring stoppages of work to an end.

The Parliamentary Secretary, who was replying to a question by Mr. Graham Page, said that statistics of stoppages terminated through voluntary negotiating machinery were not available, but a very large number were averted or brought to an end by negotiations between the parties with or without the assistance of conciliation officers of the Ministry. The Ministry of Labour does not—perhaps fortunately, said Mr. Watkinson—have a lot of written rules about industrial negotiations. If it had, its task might be even more difficult than it is. He wanted to take the opportunity of saying that in those disputes in which another union was involved the Ministry was grateful to the TUC when it could help. The TUC was in a special position to help in that kind of dispute.

Mr. Awbery suggested that this was an indication that the present industrial machinery for settling disputes was not quite adequate for the situation, and when he proposed that the Minister should consult the TUC and invite it to revise the machinery and make proposals so that disputes could be prevented in future Mr. Watkinson agreed that it might be a very good idea.

Balance between Community and Industry

Because of British Railways' 20-year reorganization plan, Metropolitan Cammell Carriage & Wagon Company, Limited, of Wednesbury, manufacturers of steel wagons, wished to expand in order to meet new requirements, it was stated by Mr. J. A. Grove for the company, at a public enquiry at Wednesbury recently, when the firm appealed against Wednesbury Borough Council's refusal to allow the use of 5¼ acres of land for industrial purposes.

Mr. Grove said the company employed 800 men at Wednesbury on work of the highest national importance. With its two Birmingham factories it was one of the largest privately-owned railway stock manufacturers in Europe. Some 70 per cent. of its output was exported and it was important that this should not be reduced to meet British Railways reorganization plans.

The appeal site had been owned by the company since 1902. It was required by the county council for use as school playing fields, but one of the two schools for which it was needed was not yet built. The appellants offered four alternative sites for playing fields.

For the borough council, the Deputy Town Clerk, Mr. W. G. Thornton, said there should be a balance between industry's demands and the community's claims. The company occupied land on the edge of a residential area and the site would be more suitably developed as playing fields.

The result of the enquiry which was heard by Mr. S. T. Roberts, of the Ministry of Housing, will be announced later.

Future Depends on Exports

Though we may often be considered a nation of shopkeepers we rank equally as a nation of exporters, and what every one of us must realize—from the chairman down to the office boy and from the works manager to the factory labourer—is that without exports Britain cannot hope to survive, nor can any of us hope to retain our present standard of living. During 1954, although we exported more than ever before, our appetite for imports outran our capacity to pay our way with increased exports. In an expanding economy such as we enjoy today, higher industrial activity and incomes at home are bound to call for increased imports of both foodstuffs and raw materials, and the only way in which we can balance our international payments is by a considerable increase in our exports.

The fact that we are living in a world in which international competition is becoming increasingly fierce was emphasized by Mr. J. P. Ford, chairman of the council of the Institute of Export, at the annual general meeting of the institute. This fierceness, he declared, applied in each of the esssential factors of price, delivery, and quality. The Institute was becoming increasingly disturbed at the continuing demand for wage increases at a time when international competition was intensifying. There was nothing wrong with wage increases as such as long as they were accompanied by increased productivity. As regards deliveries, whereas these improved greatly during the early months of 1954, they were slipping once again at the end of the year. Here, again, it must be remembered daily by both management and labour that the foreign customer was not interested in our internal problems and if we could not offer the right product at the right price and the right delivery he quite logically went next door and bought from some competing nation.

Steel Output's Latest Record

Steel production in April averaged 393,400 tons a week, which is the highest production achieved in the month of April. Last month's production compares with an average of 368,300 tons in April, 1954. Announcing these figures last week, the Iron and Steel Board pointed out that in both cases production was affected by the Easter holidays.

The annual rate of steel output for the first four months of this year was 20,320,000 tons, compared with 18,870,000 tons for the corresponding period of last year.

Pig-iron production averaged 238,500 tons a week last month, compared with an average of 232,100 tons in April, 1954.

Latest steel and pig-iron output figures compare as follow with earlier returns:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1955—January ..	236,400	12,292,000	380,600	19,789,000
February ..	241,700	12,567,000	394,200	20,498,000
March ..	240,700	12,516,000	394,900	20,536,000
1st qtr. ..	239,700	12,463,000	390,300	20,295,000
April ..	238,500	12,401,000	393,400	20,455,000
1954—January ..	229,600	11,941,000	360,300	18,737,000
February ..	222,300	11,557,000	357,300	18,577,000
March ..	230,900	12,007,000	364,800	18,969,000
1st qtr. ..	227,900	11,848,000	361,100	18,777,000
April ..	232,100	11,063,000	368,300	19,155,000

New Catalogues

Rod Cutter. Holmes and Leather, Limited, Beresford Road, Gillingham, Kent, have issued a leaflet which illustrates and describes a bench rod cutter. It is claimed that this will deal with core wire up to $\frac{5}{16}$ in. dia. It is known as the "Bantam."

Oxygen Cutting Nozzle. B. B. M. (York) Limited, Fossgate, York, have issued an eight-page booklet which illustrates and describes a range of nozzles, which is characterized by division of the inner nozzle into two components—a stud and a splined jet. These fit together by springing the jet on the stud, making a gas-tight seal and allowing automatic adjustment. This little booklet will be sent to readers on writing to Fossgate.

Level Control. The modern tendency in production control is well illustrated in a catalogue covering this subject, issued by Fielden Electronics, Limited, of Paston Road, Wythenshawe, Manchester. It deals with the Tektor J level controller, which will prevent choking of elevators or the over-loading of conveyors, or the converse. Automatically it can do many aid-to-production jobs. The catalogue is available to readers on application to Wythenshawe.

Dust Collection. Anticipating the future needs of the foundry industry is a very fine catalogue, "High-efficiency Electro-precipitation" issued by Simon-Carves Limited, of Cheadle Heath, Stockport. Of current interest is the statement that "precipitators can be designed for any capacity from a few feet up to several million cubic feet per minute." To help people to get down to the principles of the applicability of the process much data are given supplemented by a questionnaire to aid an intelligent approach to the problem. Copies of the brochure are obtainable on application to Cheadle Heath.

Foundry Plant. From Thos. W. Ward, Limited, Albion Works, Sheffield, a pleasing brochure illustrating and describing Polford foundry plant has been received. It is a wide range of plant embracing various types of sand mixers, melting furnaces, driers—to include rotary, ladle and mould varieties. Two types of screens are covered, the one being vibratory, and the other combining this system with a magnetic separator. A type of plant useful in the mechanized foundry is a compact unit for preparing facing sand. The brochure ends with details of elevator, conveyor and hopper plant. This 16-page well-illustrated catalogue is available to readers on writing to the Foundry Plant Division at Albion Works.

Electrical Resistance Materials. A leaflet, issued by Henry Wiggin & Company, Limited, describes the Brightray series of electrical resistance materials, and gives brief notes on the type of service for which each grade is intended. After 30 years of production, new grades have been brought into manufacture as a result of continual research to provide improved materials. The latest addition is Brightray "H," which is suitable for furnace elements operating in the range 1,100 to 1,250 deg. C. The complete range provides materials especially suitable for service in various conditions, meeting requirements in electrical resistances in practically all types of domestic and industrial heating apparatus. Copies of this leaflet are available from the publications department of the company at Thames House, Millbank, London, S.W.1.

CO_2 Process. A brochure received from the Harborough Construction Company Limited, Market Harborough, Leicestershire, is obviously of distinct interest at this stage of the development of the CO_2 process. The reviewer thinks that the value of the brochure would be enhanced by the early insertion of the chemical equation showing the reaction taking place between sodium silicate and CO_2. The pamphlet refers to the inherent disadvantages of sodium silicate as a binder for foundry sands, and gives this as the *raison d'être* for the development of Harmark "Gas-Bond." From this point onwards the booklet is thoroughly practical and deals with proved applications; gives information as to the more suitable sands, and their preparation, and then covers coremaking, core-blowing and mould production. A very useful appendix is included in as much as suppliers of the gas are listed for the various areas. There are sections covering the gas hardening procedure for both cores and moulds; corebox design and other features of the process. There are included no notes on the reclamation of the treated sand. However, the process is still so new and there is still so much to learn, that fresh editions will add to the not inconsiderable interest to be associated with the present one, which has been already much revised as compared with the original. The booklet is available to readers on writing to Market Harborough.

Book Review

Neuzeitliche Metallgiessereien (Modern Non-ferrous Foundries), by A. Schulenburg. Published by Fachverlag Schiele & Schön, 10 Boppstrasse, Berlin, S.W.29; price 28 D.M.

This is the third workshop book on non-ferrous foundrywork written by the same author and published by the same firm. Schulenburg, who served his time as a moulder and rose from the ranks, writes for practical foundrymen. He therefore omits everything which he expects to be common knowledge of everyone connected with foundrywork and also avoids most of those matters which he thinks belong to the metallurgist. The present book has the sub-title: "Economically successful equipment and working methods in modern non-ferrous foundries," and consists of three sections: (1) Considerations for the layout, plant and equipment to be chosen for small, medium and large non-ferrous foundries with regard to their production programmes, avoidance of cross-flow lines, reducing transport cost, and provision of adequate lighting, heating and ventilation. (2) A survey of up-to-date foundry plant and equipment, with over 270 "catalogue" photographs, taken from manufacturers' publications. This comprehensive and universal "foundry-equipment catalogue" (complete with what are obviously maker's descriptions and recommendations) contains a vast amount of technical information about German post-war foundry plant developments, from melting furnaces to moulding and coremaking machines, shotblasting, fettling and dust extraction. (3) The third section deals with modern processes such as shell moulding, precision casting, the "Busselmann" permanent-moulding process, CO_2-process, pressure- and gravity-die-casting, centrifugal casting, etc., but without going into such detail that it should be of interest to the advanced reader.

O. P. E.

Mr. K. H. HIGGINS has been appointed secretary of the British Internal Combustion Engine Manufacturers' Association.

Personal

Mr. E. L. BENNETT, of Harborne, a brassfounder, has been elected a member of the Birmingham City Council.

Mr. ERNEST ROBSON has been made deputy managing director of the Manganese Bronze and Brass Company, Limited.

SIR GEORGE BRIGGS has left the board of Round Oak Steel Works, a subsidiary of Tube Investments, Limited; of the latter Sir George is an assistant managing director.

Mr. W. CLIFFORD ATKINS has been appointed an additional director of the Aston Chain & Hook Company, Limited, non-ferrous metal engineers, of Erdington, Birmingham.

THE SANDIRON GROUP OF COMPANIES, comprising Hinckleys, Limited, Hinckleys Silica Sands, Limited, and Durhills, Limited, announce that Mr. ALAN EVANS has been appointed production manager.

THE PRIME MINISTER has approved the appointment of DAME MARY SMIETON to succeed SIR HAROLD WILES as deputy secretary in the Ministry of Labour and National Service when Sir Harold retires on June 25.

Mr. T. H. SUMMERSON, chairman and joint managing director of Thomas Summerson & Sons, Limited, railway plant manufacturers, of Darlington, has resigned his office as deputy chairman of Peterlee Development Corporation.

Mr. S. L. FINCH has been appointed joint managing director together with Mr. A. H. CATTON and Mr. D. E. CATTON, of Catton & Company, Limited, steelfounders, of Chadwick Street, Leeds, 10. Mr. A. H. Catton remains the chairman.

LAKE & ELLIOT, LIMITED, of Braintree, announce that Mr. HANS BRONNIMAN has been appointed works manager as from May 16. Mr. Bronniman was formerly works manager of Suffolk Iron Foundry (1920), Limited, of Stowmarket.

Mr. A. WALL, who at the age of 80 still carries out his duties as welfare officer at the Cardiff works of Guest, Keen & Nettlefolds, Limited, has been presented with the Iron and Steel Trades Confederation shield for his past services to the confederation.

Sir CHARLES BARTLETT has resigned from his appointment as president of the Royal Society for the Prevention of Accidents, on medical grounds. A former chairman and managing director of Vauxhall Motors, Limited, Sir Charles was elected president in October, 1953.

Sir IVAN STEDEFORD, K.B.E., chairman of Tube Investments, Limited, left by air for Canada on May 17. During his stay in North America, he will visit Montreal, Toronto, London, and New York, and also the associate company, Standard Tube and TI, Limited, at Woodstock, Ontario.

Mr. LEONARD COLKETT has been appointed secretary to C. C. Wakefield & Company, Limited, in succession to the late Mr. S. G. Jarvis. Mr. Colkett, who is 38, joined the company in 1934, and has served throughout in the secretarial department. He was appointed an assistant secretary 18 months ago.

Mr. JACK REANEY, who works in the toolroom stores of William Jessop & Sons, Limited, steel manufacturers, Brightside Lane, Sheffield, has spent 500 hours in making a model of the famous Taj Mahal in white Perspex. The model is 17 in. square, over 12 in. high, and made of 532 separate pieces.

Mr. W. W. WOOD, the Sheffield industrialist, who holds the record of having been Master Cutler five times, was installed as Town Collector of Sheffield Town Trust on May 13. Mr. Wood, who has been a Town Trustee since 1946, succeeds Dr. E. GRAMLEY, who has held the post for the past two years.

The Lord Mayor of Birmingham, Alderman J. R. BALMER, on May 6, at the Castle Bromwich, BIF, stand of William McGeoch & Company, Limited, presented to Mr. HARRY JINKS, on behalf of the firm, a cheque to commemorate his retirement. Mr. Jinks is 85 and was with William McGeoch & Company for 65 years as a brass dresser.

Sir HENRY SPURRIER, whose appointment to the board of the District Bank is announced, is managing director of Leyland Motors, Limited, and a director of Albion Motors, Limited; West Yorkshire Foundries, Limited; Self-Changing Gear Company, Limited; Commonwealth Engineering Company (Pty.), Limited, Sydney, Australia; and of other companies.

Mr. DAVID SKAE, who was elected president of Cardiff Chamber of Commerce last week, is managing director of Mountstuart Dry Docks, Limited; Barry Graving Dock & Engineering Company, Limited; Bute Shipbuilding, Engineering & Dry Dock Company, Limited; Cardiff Channel Dry Docks & Pontoon Company, Limited; and Tredegar Dry Dock & Wharf Company, Limited.

Mr. W. HAMILTON has been appointed sales manager of the engineering division of Sheepbridge Equipment, Limited, a subsidiary of Sheepbridge Engineering, Limited. Mr. A. A. HARDING, who is now welfare manager for Sheepbridge Engineering, is responsible for all Sheepbridge-group canteen, medical, personnel, and social services. Another Sheepbridge-group appointment is that of Mr. W. J. RICKARD as Midlands-area engineer for Twiflex Couplings, Limited, Twickenham (Middx).

Two assistant works superintendents appointed at the Ebbw Vale works of Richard Thomas & Baldwins, Limited, are MR. C. G. DAVIES, previously manager of the hot and cold sheet departments, and MR. L. G. STOCK, previously manager of the tinplate department. Under Mr. G. A. Young, assistant managing director of the company and general manager of Ebbw Vale section, and Mr. W. F. Gilbertson, deputy general manager and works superintendent, Mr. Davies becomes responsible for the iron and steel production and the general services of the plant, and Mr. Stock for that of the hot-strip mill, cold-reduction mills, and finishing departments.

Obituary

Mr. JAMES COMRIE, who was chief electrical engineer of the Carron Company, ironfounders and engineers, of Carron, Falkirk, died on May 4. He was 67.

Mr. HAROLD GEORGE BEAN, who was manager of the Moorhead branch of Newton, Chambers & Company, Limited, Thorncliffe, near Sheffield, died on Thursday, May 5, at the age of 54. He had been with the company for over 30 years.

Mr. J. SIDNEY HAMPTON, director and general manager of Davy & United Roll Foundry Limited for their works at Haverton Hill, Middlesbrough, has died at the age of 62. The firm is a subsidiary of Davy & United Engineering Company, Limited, Sheffield. Mr. Hampton went from Birmingham to Tees-side 20 years ago.

Company News

BAKER PERKINS, LIMITED—The directors propose that £442,166 be capitalized and distributed in the proportion of one new share to every three £1 units of ordinary or "A" ordinary stock held.

HARRISON (BIRMINGHAM), LIMITED, brassfounders, etc.—In addition to a dividend of 1s. 3d., which is the same as for the previous year, the directors recommend a bonus of 3d. (nil), free of tax, for 1954.

RICHARDS (LEICESTER), LIMITED, ironfounders and structural engineers—A marketing has been arranged on the Birmingham Stock Exchange of the company's one-class capital, which consists of £200,000 issued in 5s. ordinary shares.

STANDARD MOTOR COMPANY, LIMITED—The company has completed arrangements with Fisher & Ludlow, Limited, car-body manufacturers, to ensure a continuance of adequate body supplies for Standard cars. The arrangement has been agreed by the British Motor Corporation, Limited, which absorbed Fisher & Ludlow in 1953.

CROFTS ENGINEERS (HOLDINGS), LIMITED—Sir Arthur Croft, chairman, announced at the annual meeting that since the issue of the accounts application had been made to the CIC and consent received for issues of shares by way of capitalization of reserves and for cash. It was, therefore, proposed to call shareholders together again shortly to obtain their consent to the board's proposals.

ALBRIGHT & WILSON, LIMITED—Treasury consent has been obtained to an issue by way of capitalization of reserves of one 5s. ordinary share for every two 5s. ordinary stock units already held. It is intended to make the issue to stockholders registered on May 24 and an extra-ordinary meeting will be held after the annual meeting on June 2 for the purpose of passing the appropriate resolutions.

WOODALL-DUCKHAM CONSTRUCTION COMPANY, LIMITED—The preliminary profits statement indicates that 1954 was the group's best year since the company was made public in September, 1948. Untaxed group profits have increased by £90,602 to the peak of £1,039,932, and as the tax provision is down by £77,281 to £571,649, etc., the net balance for the holding company has increased by £164,265 to £435,783.

LAKE & ELLIOT, LIMITED, steelfounders, of Braintree (Essex)—The company is effectively doubling the interim payment at 5 per cent., less tax, on the £300,000 ordinary capital, in respect of the year to July 31, 1955. The previous interim dividend of 5 per cent. was paid on the £150,000 capital before a 100 per cent. scrip issue. A final of 7½ per cent. on the enlarged capital made the equivalent of 10 per cent.

ENFIELD CABLES, LIMITED—The main reason for unsatisfactory results for 1954 was a substantial decrease in turnover—especially in export business, says the chairman, Sir Philip Warter, in his statement with the accounts. The fall in turnover was most severe in the more profitable products and such export business as was obtained showed very unsatisfactory margins. A considerable loss was incurred in the contracts department and steps have been taken to overhaul this department.

DUNLOP RUBBER COMPANY, LIMITED—The group's trading balance expanded from £15,488,545 in 1953 to £17,717,914 last year, and the available net profit from £4,068,426 to £4,858,500. A year ago, however, the balance was raised by £885,560 with a final EPT refund. With a 10 per cent. final dividend recommendation, the directors are maintaining the annual distribution at 14 per cent. on the £19,280,954 ordinary capital. Following a 50 per cent. capitalization when the 6s. 8d. ordinary units were written up to 10s. stockholders received a 12 per cent. dividend plus 2 per cent. bonus for 1953.

ELLIOTT BROS. (LONDON), LIMITED, manufacturers of electrical measuring instruments, etc.—The board has been considering the question of raising additional share capital in view of the present programme of expansion and development. No decisions have yet been made, reports the chairman, Mr. R. E. F. de Trafford, in his 1954 statement. He points out that although substantial amounts of new plant have been acquired during the last few years, it has been necessary to step up the rate of purchase, and for this reason commitments at the end of 1954, at £84,000, show a marked increase over 1953.

BABCOCK & WILCOX, LIMITED—Output of the group attained a record value in 1954, and the value of unexecuted orders on hand at the year-end, in spite of continuing competition, stood at a "satisfactory" level. In his statement with the full accounts, Mr. W. Lionel Fraser, the chairman, says the betterment in raw material supplies, with higher output, naturally resulted in some reduction in volume of unfulfilled orders. Transfers for 1954 have increased group reserves and surplus to £11,176,168 (£9,185,767). Mr. Fraser says substantial allocations have been made for machinery and plant as it is believed the rapidly changing operating conditions can only be met by developing and extending ranges of designs and manufacturing facilities.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade, Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone CHAncery 4411, ext. 738 or 771), unless otherwise stated.

BIRMINGHAM, May 25—650 cast-iron columns, 400 swanneck brackets, and 100 tubular steel columns, for the 12 months commencing July 1, 1955, for the Public Works Committee. The City Engineer and Surveyor, Civil Centre, Birmingham.

INDIA, May 25—Turbine pumping sets for tube wells, for the Directorate-General of Supplies and Disposals, Government of India. (ESB/9835/55.)

LARNE (ANTRIM), May 25—Spun-iron pipes and special castings and valves and hydrant fittings, for the Town Council. The Borough Surveyor, 8, Victoria Road, Larne.

NOTTINGHAM, May 28—Cast-iron pipes, special castings, irregular special castings, miscellaneous iron castings, sluice valves and hydrants, and gunmetal fittings, for the 12 months ending June 30, 1956, for the City Council. Mr. B. W. Davies, engineer and general manager, Water Department, Castle Boulevard, Nottingham.

PHILIPPINES, September 15—Machinery and equipment for cement plant, for the Republic Cement Corporation, Manila. (ESB/9815/55.)

POCKLINGTON (YORKS), June 4—600 yds. of 3-in. dia. spun-iron mains, for the Rural District Council. John H. Haiste & Partners, consulting engineers, Queen Square, Woodhouse Lane, Leeds, 2. (Deposit, £3 3s.)

PORTUGUESE EAST AFRICA, July 12—Spare parts for railway rolling stock, for the Ports, Railways, and Transport Department, Lourenço Marques. (ESB/9718/55.)

SPAIN, June 7—Water-conditioning plant for locomotives, 40 20-ton open railway wagons, and three 3-ton motor cranes on pneumatic tyres, for the Junat de Obras y Servicios del Puerto de Gijon-Musel. (ESB/9589/55.)

SPILSBY (LINCS), May 30—Valves and fittings for pipelines, for the Rural District Council. Binnie, Deacon & Gourley, engineers, Artillery House, Artillery Row, Westminster, London, S.W.1. (Deposit, £5.)

TURKEY, June 10—Permanent way materials, for the Directorate-General for the exploitation of the Turkish State Railways. (ESB/9682/55.)

WICKLOW (EIRE), May 18—Electric motors, switchgear, etc., for the complete conversion to electric power of all crushers, conveyors, screens, tarmacadam plant, etc., in the quarry at Ballinclare, Kilbride, for the County Council. The Courthouse, Wicklow. (Deposit, £5 5s.)

News in Brief

STERLING FOUNDRY SPECIALTIES, LIMITED, Bedford, have received permission to erect a single-storey depot on Sighthill Industrial Estate, Edinburgh, at a cost of £6,500.

B.O. MORRIS LIMITED, Briton Road, Coventry, have designed and placed on the market the Morrisflex electronic grinding indicator, which indicates the precise instant of contact to the operator when grinding wet.

A THIN VEIN of uranium has been found in Scotland by two amateur prospectors, it is announced by the Atomic Energy Division of the Geological Survey, South Kensington. The discovery was made in an old lead mine in the hills of western Perthshire.

CALLENDER-HAMILTON bridging to the value of £118,000 has been ordered from British Insulated Callender's Construction Company, Limited, by the Government of New South Wales for road reconstruction work in the areas recently devastated by floods.

SHEEPBRIDGE EQUIPMENT, LIMITED, have recently shipped two 175-h.p., electrically-operated, single-drum haulages, thus completing a recent contract for the supply of colliery equipment to the Digwadi and Sijua collieries of the Tata Iron & Steel Company of India.

WITH A PAPER on "Steelworks Waste-heat Boiler Practice," Mr. Robert McDonald, boiler superintendent and steam engineer at Colvilles' Dalzell works, Motherwell, has been awarded the Williams prize of £100 for session 1954-55 by the Council of the Iron and Steel Institute.

THE HARDINGE No. 1 and 2 factories at Feltham, Middlesex, are now being extended to increase the 1955 output of the firm's lathes by 300 per cent. compared with the 1954 production total. Hardinge Machine Tools, Limited, is a subsidiary of Sheepbridge Engineering, Limited.

EDWARD PRYOR & SON, LIMITED, makers of marking devices, Broom Street, Sheffield, were visited by Alderman J. H. Bingham, Lord Mayor of Sheffield on May 11. He was shown round by Mr. A. Throp, the firm's technical director, and saw three-dimensional pantograph engraving machines at work.

THE FACTORIES of George Kent, Limited, engineers, at Luton (Beds) and London will be closed for the annual works holiday from July 15 to August 2. The South Wales factory at Resolven will be closed from July 23 to August 7. Offices at the factories will remain open during the holidays.

THE DIRECTORS of the Peterborough Die Casting & Machine Company, Limited, entertained some 70 employees and friends at a dinner and social evening. Tributes were made to the work of Mrs. I. E. Stock, chairman, in continuing the business following the death of her husband, the former chairman, Mr. H. A. Stock.

THE GAS INDUSTRY had every reason to be concerned by the ever-increasing costs falling upon it and particularly "by the discrimination applied to our industry in the price of coal," Mr. G. le B. Diamond, chairman of the West Midlands Gas Board, said at the jubilee dinner of the Midland Junior Gas Association at Wolverhampton last Saturday.

LAMBETH & COMPANY (LIVERPOOL), LIMITED, Greenock Street, Liverpool 3, have decided, not being specialists in the foundry industry, to hand the whole of their interests in "Totanin" and "Totanin D" to Mr. A. J. Perrins, of 15, Chester Road, Wrexham (Telephone No.: Wrexham 3750), through whom in future all business and enquiries will be handled.

A NEW WORKS of 10,000 sq. ft. is to be established in Etobicoke Township, Ontario, Canada, by Hall & Pickles, Limited, the Manchester steel and toolmaking concern. The company's first venture in North America, the works will be operated by a subsidiary, Hall & Pickles Canada, Limited. Production will start in July on a wide range of printed metal tags and labels, and high-speed cutting tools will be manufactured later.

THE INTERNATIONAL FURNACE EQUIPMENT COMPANY, LIMITED, of Aldrich, Staffordshire, announce that they have received a further order for a GI two-stage gas generator for the production of clean gas from the English Steel Corporation, Limited, of Sheffield. This is the third plant of this type to be installed at the River Don Works of the English Steel Corporation, Limited, two others having been installed about a year and a half ago.

RECENTLY the Thorncliffe works of Newton Chambers & Company, Limited, Chapeltown, were visited by Alderman J. H. Bingham, Lord Mayor of Sheffield. He was welcomed by Sir Harold West, managing director. During his visit he saw works in progress in the various departments; the works' business training college, where girls from 15 to 18 are given secretarial training and further education; and Newton Chambers' own permanent exhibition.

A STATEMENT issued by the committee of the Birmingham Exchange and Engineering Centre says that in view of the announcement of the purchase of the exchange buildings by the Birmingham Real Property Company it is felt that exhibitors and other users of the centre will be interested to know that the present lease does not expire until March, 1961. Furthermore, it is anticipated that the engineering centre will then be accommodated, in a new building.

THE SECOND production exhibition and conference of the Institution of Production Engineers will be held in the Grand Hall, Olympia, London, from May 23 to 31. It will deal with productivity in British industry, and its importance in ensuring the country's economic progress. All enquiries regarding the 1956 exhibition should be made to S. D. Cooke, Andry Montgomery, Limited, 11, Avenue Chambers, 4, Vernon Place, London, W.C.1, tel.: CHAncery 2223/7.

AMONG the principal instruments which Foxboro-Yoxall will be presenting on stand 7.F at the British Instrument Industries Exhibition from June 28 to July 9 are: the model 40 Cyclelog, a camless controller which automatically controls batch processes according to predetermined time schedules; a Stabiload cylinder for pneumatic loading and the Dewcel system for measuring humidity directly in terms of Dewpoint. Many other types of recorders, controllers, and electronic instruments will also be on show.

A REPLICA of a tattered copy of the old rules of a Sick and Dividing Society of the Dannemora Steel Works was handed to visitors at the inauguration of a battery of Gibbon's heat-treatment furnaces at the Broughton Lane works of Arthur Balfour & Company, Limited, Sheffield, on May 5. Among the club's rules were—Not cleaning ingot shed up on Saturday morning, odd men, fine 3d. each; odd men not sweeping floor up, fine 6d.; any man coming to work in a dirty shirt and unshaved on Monday morning, fine 1s.

RILEY STOKER COMPANY, LIMITED announce that the name has been changed to Riley (IC) Products, Limited, and the company will operate under this name as from June 1. This step has been taken having in mind that in addition to mechanical stokers of all types, which was the main interest of the company for many years pre-war, it is now interested in kiln firing, incinerators, coal conveying plant, Syntron electric vibratory equipment and so forth. The company is a member of the International Combustion Group.

COUNCILLOR F. V. SIMMONS, at a recent meeting of Carrickfergus Borough Council, announced that negotiations are now in progress for the initiation of a new ship-breaking industry at that port which is located on Belfast Lough and only some 8 miles seawards from the Northern Ireland capital. The proposed scheme is being sponsored by Mr. John Lees of Belfast, in conjunction with the Northern Ireland Minister of Commerce, and already several of the leading foundries and machine makers in that region have promised their support.

THREE COPIES of a hand-written weekly newspaper have been found among old documents of Newton Chambers & Company, Limited, Thorncliffe Works, Chapeltown, near Sheffield. The discovery is referred to in the "Thorncliffe News," the successor of these early copies of the firm's paper. It was called "The Repository" and is thought to have been passed from hand to hand over 130 years ago. It is written in copper-plate writing and the six joint-editors include a Thomas Newton and Matthew Chambers, sons of the firm's original partners.

A PARTY of 200 stockholders of Associated Electrical Industries, Limited, recently toured the Rugby works of the British Thomson-Houston Company, Limited, a member of the AEI group. Earlier another party of 200 stockholders had toured the Trafford Park works of the Metropolitan-Vickers Electrical Company, Limited. Viscount Chandos, chairman of AEI, announced in his annual statement his intention to invite two parties of stockholders to visit the factories of the group. In all, some 1,000 stockholders applied for the visits, and the choice was made by ballot.

BRITAIN was inviting overseas business on the basis of asking customers to buy "a pig in a poke" said Mr. L. S. Berry, chairman of the National General Export Merchants' group, at the Castle Bromwich British Industries Fair. Mr. Berry said far too many manufacturers were quoting prices ruling at the date of delivery —a system introduced during the war. With quite different conditions ten years after the war, this system was still the rule, yet Britain's biggest competitors had always quoted firm prices. There was no doubt that a lot of business was lost to this country as a result of this system.

THE INSTITUTE OF MATERIALS HANDLING, Midland division, is organizing a series of one-day courses at Droitwich designed for senior management representatives to bring them up to date with the latest materials handling methods. The courses will run from May 16 to 25 and among the speakers will be Mr. John Bright, chief planning engineer of Joseph Lucas, Limited, who is national chairman of the Institute; Mr. H. Dixon, factory lay-out engineer of the same firm; Mr. T. Bowes, materials handling engineer of Henry Wiggin & Company, Limited, and Mr. J. R. Mundy, of Courtaulds, Limited, Coventry.

THE FIRST Technical Colleges and Industry Conference was held in Sheffield on May 11. Representatives of the Federation of British Industries and the Yorkshire Council for Further Education and other sponsoring bodies, took part. Mr. D. R. O. Thomas, chief education officer, United Steel Companies, Limited, asked colleges to invite industrial students to see their programme of studies, and *vice versa*, and suggested the formation of a working party to ensure closer co-operation between Sheffield industrialists and technical college staffs. Another conference is to be called to consider progress in further education in industry.

THE Minister of Pensions and National Insurance, Mr. Osbert Peake, has asked the National Insurance Advisory Committee to review the classification of persons engaged in part-time employment and the liability for contributions in respect of such employment. This is part of the review of the National Insurance scheme to which Mr. Peake referred in his speech on the Second Reading on the National Insurance Bill on December 8, 1954. The Committee will consider representations on the question. Such representations should be in writing and should be made before August 10, 1955, to the Secretary, National Insurance Advisory Committee, 10, John Adam Street, London, W.C.2.

AS THE RESULT of a three-month survey carried out near the James Bridge Copper Works, Limited, Darlaston Road, Walsall, by officials of Walsall Corporation Health Department, the firm is to be asked to consider immediately the question of improvements to the works, particularly the furnaces, to alleviate smoke, dust and noise nuisance. In a special report to Walsall Town Council the chief sanitary inspector, Mr. C. A. Stansbury, states that during the survey 1,129 visits were made to 720 houses and 547 tenants completed questionnaire forms. The most serious complaint was of excessive smoke and fumes. "All the pollution does not necessarily come from the Copper Works" the reports adds, and says that "the company has gone to considerable lengths during recent years in an effort to ameliorate the conditions. Some of the problems, particularly that of low-level emission from the furnace houses, are technically difficult to solve in this particular works."

ENGLISH STEEL CORPORATION, LIMITED, announce the formation of a new wholly-owned subsidiary under the name of Davis & Lloyd (1955), Limited, which has taken over the interests of the well-known firm of Davis & Lloyd, Limited, of 26, Victoria Street, London, in the design and production of cast-steel side-frames and bolsters, cast-steel unit brake beams, snubbers and other similar parts and appliances for railway rolling-stock. Mr. Ernest Lloyd, for many years principal partner of Davis & Lloyd and later chairman and managing director, who has retired from the company, will continue to be available in a consultative capacity. Mr. F. Mason, who was also a director of the old company, becomes a Director of the new organization. Mr. F. Pickworth, managing director of English Steel Corporation, Limited, and Dr. C. J. Dadswell, a director, become chairman and managing director respectively of Davis & Lloyd (1955), Limited, with Mr. F. S. Beale (a director of English Steel) also on the new Board.

AFS Awards

At the forthcoming Texas convention of the American Foundrymen's Society, the following awards will be made. The John H. Whiting medal to Mr. John B. Caine; the Peter L. Simpson medal to Mr. J. E. Rehder; and the John A. Penton medal to Mr. Robert F. Thomson. Honorary life membership has been accorded to Mr. Albert F. Pfeiffer, Mr. Frank C. Riecks, and Mr. Frank J. Dost, the retiring president of the Society.

Runner and Riser Basins

By "Tramp"

To ensure clean, trouble-free castings, it is essential that as much care be exercised in the preparation of the runner basin as of the mould itself. For important medium-size castings, subjected to a fair amount of machining, it is wise to make the runner basin along with the mould and dry both together. For smaller work, runner bushes may be produced by means of a special machine or made as cores, and later placed on the mould prior to casting.

To ensure absolute cleanliness, some moulders black-wash these dried bushes when they are placed on the mould, but exceptional care must be taken to ensure that no blacking trickles down the runner and lodges in the mould, causing a "waster" by reason of malformation of the casting.

Riser basins are not so important as runner basins, and these are often built on the mould after assembly and just prior to casting. It is better, however, not to build them when the top box is in position as there is the chance of sand being carried down the riser, again a feature which can give rise to "wasters." A better way is to try on the top box in position, then lift it on to suitable stands, build up the riser and finally return the top to its position.

For smaller work, riser cups can be used, but it is not economic to use runner-bush cores for this purpose. The writer once traced a number of wasters to this misuse of runner bushes. The castings in question were required to be particularly sound and a few inches of "head" were necessary to ensure the requisite metal pressure. A number of these castings turned out to be defective and the cause was ultimately traced to the use of runner bush cores for riser cups. The riser was 1-in. dia. and the hole in the core ¾ in. The core was secured to the top box by means of core gum. On casting, the ascending column of metal in the riser compressed the air between the face of the metal and the bush—which had been covered down—with the result that the pressure acting on the annular face of the core was sufficient to dislodge it, thus reducing the available "head" in the mould and accounting for the "waster."

Stock Core Causes "Waster"

By "Coroner"

Round cores of various diameters produced on an extrusion machine are often referred to in the foundry as "stock" cores, and are very useful for many jobs. Occasionally, however, their use is to be deprecated, as they may not stand up to the stress imposed on them by the pressure of the metal, especially when situated in a horizontal position at the bottom of a deep mould. For such jobs, a corebox should be provided, so that cores reinforced by means of bars could be prepared and used in places where trouble may be expected.

Recently a "waster" casting was the subject of an "inquest" and the cause was traced to a "stock" core. This particular casting, weighing about 10 cwt., consisted of a body on a fairly large base, the interior of the casting being cored out. The mould was split along the horizontal plane and a 1-in. dia. core was used to produce a hole in the base. When the mould was being assembled, the moulder usually on the job was absent, and another workman used a piece of stock core for this hole and built over the drop point by means of a building board, instead of using the specially prepared core as had been the practice previously. The job was poured quietly, but after the ladle of metal had been removed, "blowing" began to take place in the riser basin. This was attributed to the use of damp sand for the basin, but when the casting was removed from the mould, a large defect was discovered in the vicinity of the small core. It was then revealed that the proper core had not been used and this was the cause of the trouble.

The "stock" core did not resist the up thrust of the metal, with the result that it broke and the gases escaping from it caused the "blowing" in the riser. The broken portion of the displaced core had floated out of position and caused the large defect which was responsible for the casting being scrapped.

This experience not only shows the limitations to the use of "stock" cores, but also "points the moral" that when a new man is put on a job he should be given all the information about it, if such accidents are not to occur.

New Equipment

Fork-lift Truck for Small Spaces

An entirely new 5-ton fork-lift truck only 5 ft. wide and with a turning radius of 9 ft. 8 in. has been introduced by Shelvoke & Drewry, Limited, Letchworth (Herts). It is primarily designed for industrial premises where heavy loads must be handled and operating space is at a premium.

As the normal operating surface will be either concrete or asphalt, solid tyres are preferred to pneumatics, which may suffer damage from swarf and other scrap metal. Manœuvrability is increased by the hydraulically assisted steering, which is effortless to the driver and, at the same time, enables full lock to be applied irrespective of whether the truck is moving or stationary.

Although the rated capacity of the truck is 12,000 lb., in compliance with fork-truck standard practice, this is upon the assumption that the centre of gravity of the load will be at 24 in. from the heel of the forks, and the makers suggest that many instances will occur where the truck will be used to overcome the problem of lifting loads of 2 to 3 tons at a considerably greater distance than was formerly possible with small-capacity trucks.

Scrap Trade Unity

The view that some consideration should be given to a campaign for extending membership of the Federation to those who, while outside, nevertheless gained all the advantages which were derived from Federation activity, was expressed by Mr. C. Roberts, of Sheffield, representing the Yorkshire Scrap Iron, Steel, and Metals Association, at the annual conference of the National Federation of Scrap Iron, Steel, and Metal Merchants, held at Harrogate. Mr. Roberts, who was installed as national president for 1955-56, agreed that they could not stop such people from trading, but they might try to make it difficult for them to do so.

Mr. David E. Wilson, chairman and managing director of D. E. Wilson & Company (Metals), Limited, Morfa, Llanelly, a former chairman of the South Wales and Monmouthshire Association of Iron, Steel, Tinplate, and Metal Scrap Merchants, and a former High Sheriff of Carmarthenshire, was named as president-designate of the Federation.

Mr. M. Henderson Clark, of the North East Association of Iron, Steel, and Metal Merchants, the retiring president of the Federation, told the conference that the Working Party on Old Metals, set up by the Ministry of Supply to clarify and modernize the law regulating the industry, had completed its task and that the next step would be in the form of legislation.

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FS 14

Raw Material Markets

Iron and Steel

Notifications of rises in rail freight charges and coal prices on June 5 bring into the immediate foreground the prospect of a general revision of iron and steel prices.

Working under extreme pressure, the blast furnaces still cannot keep pace with the demand for pig-iron. The planned increase in the number and size of the blast furnaces is designed to achieve an ultimate output of 15,000,000 tons per annum, but the development programme cannot be hurried and in the meantime imports are increasing to meet the more pressing needs of the steel plants and the foundries.

Imports of ore this year have hitherto been on a reduced scale, but bigger tonnages are now on the way in anticipation of the lighting of new blast furnaces in the third quarter of the year. This additional capacity, however, is mainly dedicated to the service of the steel plants and the foundry trade is still facing the prospect of meagre supplies of hematite and low- and medium-phosphorus irons.

Re-rollers are still worried about the shortages of billets, sheet bars, and slabs. They have recently been receiving small consignments of foreign material to supplement the limited deliveries from home sources, but the aggregate tonnages received are not nearly sufficient and it is becoming very difficult to buy steel semis on the Continent, where supplies are becoming both scarce and costly. One way or another the mills have been kept running and there is no lack of orders.

The demand for sheets has so completely outdistanced expectations that it is learnt that the Iron and Steel Board has been invited to approve a revision of the second development plans which will embrace further additions to sheetmaking and tinplate capacity. Meanwhile, the flow of imports is to be accelerated. Big orders for steel pipes for the Middle East have been booked, and delivery dates for plates, joists, sections, etc., to home consumers are extending. There is a large unsatisfied demand for ferro-concrete bars and wire rods.

Non-ferrous Metals

There was a certain amount of doubt about how the market would react towards the R.S.T. special price of £280, and perhaps there were few who thought that initially at any rate the effect would be virtually nil. During the first half of last week the market was steady and unchanged at around £304 to £305 for cash, with three months about £291, but on Thursday a squeeze developed in unofficial trading as a result of which there was an advance to £317 for cash and £302 for three months. Of course, none of the "cheap" Rhodesian copper comes near the market, but one of the R.S.T. customers is reported as being a seller at £286 ex-works basis, which certainly looks cheap alongside £321. Whether much is being disposed of at that level is not known, but presumably this special price will, at present anyway, be applied only to regular customers of the firm. Just what the ultimate effect on the overall level of semis prices will be has yet to be seen. It has been wondered whether a Canadian producer who operated a special price scheme early this year will revert to the plan. Many people, while applauding the intention to achieve stability, believe that the plan cannot succeed in a worthwhile fashion.

Reference has already been made to the squeeze in copper and the resultant higher price. By Friday afternoon the seller's price of cash was £321 and of three months £303, the "back," therefore, amounting to £18, considerably more than has been the rule for a long time past. On balance cash improved by £16 10s. and three months by £12, so that ironically the launching of another stability scheme has coincided with a swift upturn in the market. Tin has also quite a firm market, for cash gained £7 to £7 7s. and three months £4 10s. to £718, the contango being reduced to £1. Zinc gained £1 for first half May and 15s. for first half August. Lead was 15s. up prompt, but only 10s. better for three months.

Official prices were as follow:—

COPPER, Standard—*Cash:* May 12, £312 to £313; May 13, £321 to £322; May 16, £321 to £322; May 17, £325 10s. to £326; May 18, £324 to £326.

Three Months: May 12, £297 10s. to £298; May 13, £303 to £304; May 16, £304 to £305; May 17, £307 to £307 10s.; May 18, £306 to £308.

TIN, Standard—*Cash:* May 12, £714 to £714 10s.; May 13, £716 10s. to £717; May 16, £713 to £714; May 17, £711 to £713; May 18, £712 10s. to £713 10s.

Three Months: May 12, £715 to £717; May 13, £718 to £719; May 16, £715 10s. to £716; May 17, £714 to £714 10s.; May 18, £714 10s. to £715 10s.

LEAD—*First half May:* May 12, £102 15s. to £103; May 13, £103 10s. to £103 15s. *Second half May:* May 16, £103 5s. to £103 15s.; May 17, £103 5s. to £103 10s.; May 18, £103 to £103 5s.

First half August: May 12, £103 to £103 5s.; May 13, £103 10s. to £103 15s. *Second half August:* May 16, £103 5s. to £103 10s.; May 17, £103 to £103 5s.; May 18, £102 15s. to £103.

ZINC—*First half May:* May 12, £89 10s. to £89 15s.; May 13, £89 15s. to £90. *Second half May:* May 16, £89 10s. to £89 15s.; May 17, £89 5s. to £89 10s.; May 18, £89 5s. to £89 15s.

First half August: May 12, £88 5s. to £88 10s.; May 13, £88 5s. to £88 15s. *Second half August:* May 16, £88 to £88 5s.; May 17, £88 to £88 5s.; May 18, £88 to £88 5s.

New British Standard

Glossary of terms used in radiology

This new British Standard (B.S. 2597 : 1955) is intended as an authoritative reference for medical and industrial radiologists and for general workers in radiology. It includes over 750 terms and definitions. Its four main sections are, "General terms and physics"; "Sources of ionizing radiation"; "Radiography and fluoroscopy" and "Radiotherapy and radiation protection"; and its comprehensive nature may be visualized by the fact that among these sections are terms relating to such subjects as: atomic physics, high voltage generating equipment, X-ray tubes and their accessories, particle accelerators, diffraction analysis, and isotopes in medicine. Where appropriate, quantitative values and symbols are given for the various terms. A complete alphabetical index is included. Copies of this British Standard may be obtained from the British Standards Institution, Sales Branches, 2, Park Street, London, W.1. Price 10s. net.

Mr. T. HURST, the author of "Re-designing of Steel Castings to ensure Soundness and Reduce Costs," desires to express his thanks to the directors of the Darlington Forge Limited for their permission to publish.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

May 18, 1955

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £15 12s. 0d.; Birmingham, £15 5s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 13s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £18 9s. 3d.

Scotch Iron.—No. 3 foundry, £18 2s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £20 4s. 0d.; South Zone, £20 6s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £21 1s. 6d.; South Zone, £21 4s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £18 2s. 6d.; Scotland (Scotch iron), £18 9s. 0d.; Sheffield, £19 7s. 6d.; Birmingham, £19 14s. 6d.; Wales (Welsh iron), £18 9s. 0d.

Basic Pig-iron.—£15 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £40 15s. 0d., basis 45 per cent. Si, scale 15s. per unit; 70/84 per cent., £63 0s. 0d., basis 75 per cent. Si, scale 16s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £161 0s. 0d. to £165 0s. 0d. per ton; 38/40 per cent., £258 0s. 0d. to £262 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 16s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 19s. 7d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £83 0s. 0d. to £85 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £81 0s. 0d. to £82 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 10d. per lb. Cr; 1 per cent. C,* 1s. 11d. per lb. Cr; 0.15 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr; 0.10 per cent. C,* 1s. 11d. to 2s. 2d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 7½d. to 7s. 1d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £259 0s. 0d. to £265 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £53 17s. 6d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 5s. 0d.; tested, 0.08 to 0.25 per cent. C, £26 5s. 0d.; hard (0.41 to 0.60 per cent. C), £27 10s. 0d.; silico-manganese, £34 10s. 0d.; free-cutting, £29 6s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 17s. 0d.; silico-manganese, £34 10s. 0d.

* Average 68-70 per cent.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 15s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £33 11s. 6d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 19s. 6d.; flats, 5 in. wide and under, £31 19s. 6d.; hoop and strip, £33 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £34 5s. 0d.; black sheets (hand mill), 17/20 g., £43 13s. 6d.; galvanized corrugated sheets, 24 g., £55 4s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £54 7s. 9d.; nickel-chrome, £76 7s. 9d.; nickel-chrome-molybdenum, £86 8s. 6d.

NON-FERROUS METALS

Copper.—Cash, £324 0s. 0d. to £326 0s. 0d.; three months, £306 0s. 0d. to £308 0s. 0d.; settlement, £326 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 3s. 1d. per lb.; rods, 360s. 0d. per cwt. basis; 20 s.w.g., 393s. 3d. per cwt.

Tin.—Cash, £712 10s. 0d. to £713 10s. 0d.; three months, £714 10s. 0d. to £715 10s. 0d.; settlement, £715 10s. 0d.

Lead (Refined Pig).—Second half May, £103 0s. 0d. to £103 5s. 0d.; second half August, £102 15s. 0d. to £103 0s. 0d.

Zinc.—Second half May, £89 5s. 0d. to £89 15s. 0d.; second half August, £88 0s. 0d. to £88 5s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £120 10s. 0d.; rolled zinc (boiler plates), all English destinations, £118 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £103 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 5d. per lb.; rods, drawn, 3s. 3½d.; sheets to 10 w.g., 323s. 9d. per cwt.; wire, 3s. 1½d.; rolled metal, 309s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £206; B6 (85/15), —; BS249, £213.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £261; HTB2 (38 tons), £270; HTB3 (48 tons), £279.

Gunmetal.—RCH, 3/4 per cent. tin. £278; BS1400, LG2 (85/5/5/5), £280; LG3 (86/7/5/2), £288; G1 (88/10/2/½), £359; (88/10/2/1), £350.

Phosphor Bronze.—BS1400, PB1 (AID released), £375 per ton.

Phosphor Bronze Strip, etc.—Strip, 449s. 6d. per cwt.; sheets to 10 w.g., 473s. 0d. per cwt.; wire, 4s. 7½d. per lb.; rods, 4s. 0d.; tubes, 3s. 10½d.; chill cast bars: solids 4s. 0d., cored 4s. 1d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide x 0.056, 3s. 10½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 3½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £108 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £163 0s. 0d.; aluminium bronze (BS1400), AB1, £333; AB2, £346. Solder, brazing, BS1845, 2s. 10d. lb.; granulated, 3s. 2d. lb.